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Forest Service
State and Private
Forestry
Forest Health Protection
Intermountain Region
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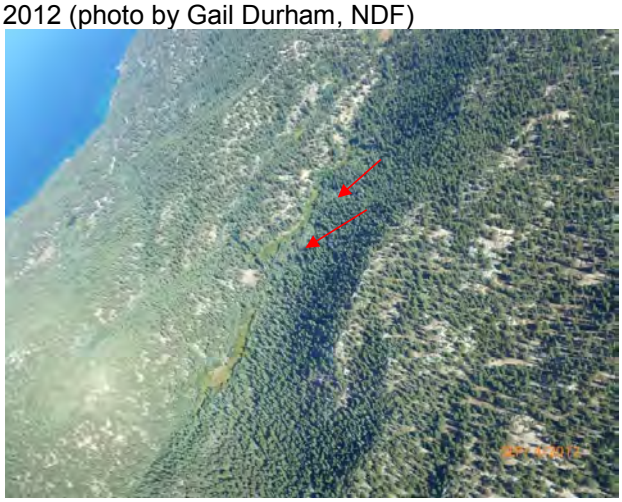
State of Nevada

Division of Forestry
Department of
Conservation and Natural
Resources

2012 Forest Pest Conditions In Nevada

Aspen defoliation on top of Table Mountain in the Monitor Range in Central NV, August, 2012 (photo by Gail Durham, NDF)



White satin moth defoliation of aspen in North Canyon above Lake Tahoe in early September 2012.

Forest Health Specialists

Forest Health Protection

USDA Forest Service
Ogden Field Office
Forest Health Protection
4746 S 1900 E
Ogden, UT 84403
Phone: 801-476-9720
FAX: 801-479-1477
Steve Munson, Group Leader
Email: smunson@fs.fed.us
Darren Blackford, Entomologist
Email: dblackford@fs.fed.us
Danielle Reboletti, Entomologist
Email: dreboletti@fs.fed.us
Valerie DeBlander, Forestry Technician
Email: vdeblander@fs.fed.us
John Guyon II, Pathologist
Email: jguyon@fs.fed.us
Elizabeth Hebertson,
Entomologist/Pathologist
Email: lghebertson@fs.fed.us
Laura Dunning, Program Assistant
Email: ldunning@fs.fed.us

Nevada Division of Forestry

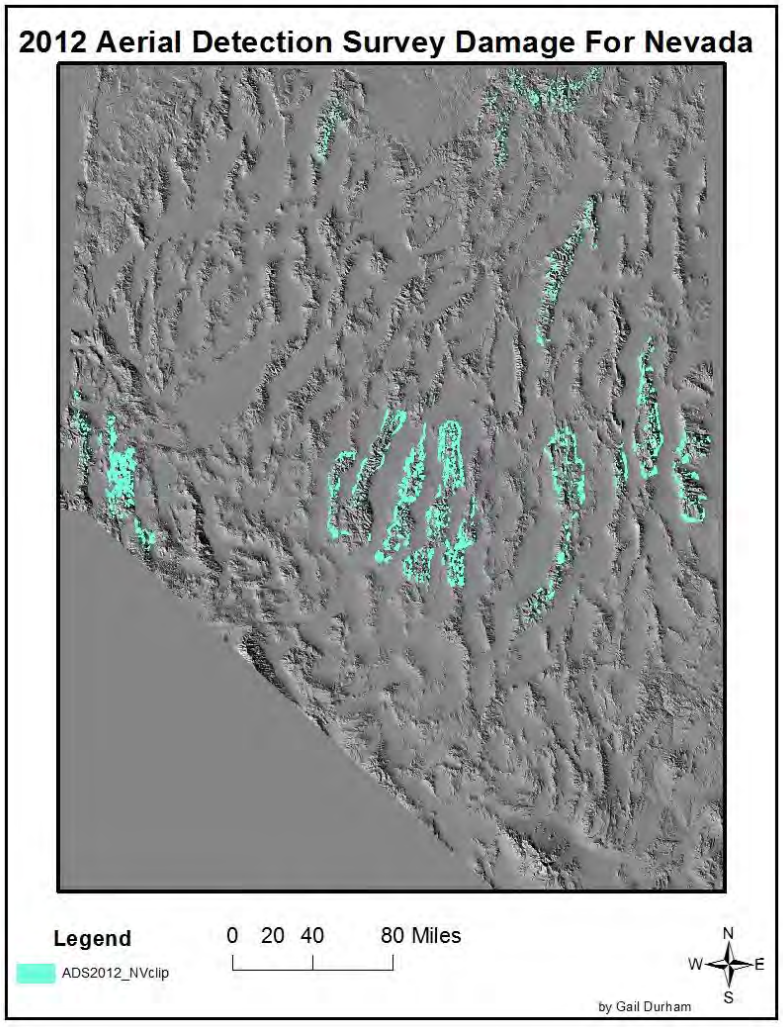
Department of Conservation
and Natural Resources
State Headquarters
2478 Fairview Dr.
Carson City, NV 89701
Gail Durham, Forest Health Specialist
Email: gdurham@forestry.nv.gov
Phone: 775-849-2500 Ext..241

John Christopherson, Resource
Program Manager
Email: jchrist@forestry.nv.gov
Phone: 775-684-2507

Compiled by:
Gail Durham, Forest Health Specialist, NDF DCNR
Edited by Danielle Reboletti, USFS, Entomologist

With Contributions from:
Dick Halsey, USFS FHP GIS Specialist
John Guyon II, USFS FHP Pathologist
Jeff Knight, Nevada State Entomologist
Dr. Shouhua Wang, Nevada State Pathologist

April 2013



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INTRODUCTION AND SUMMARY

In an effort to simplify discussions of forest health conditions in Nevada, this report focuses on only insects, diseases, and weather factors that impacted various tree species in the State. Data collected through aerial detection surveys (ADS) conducted by the USDA Forest Service and Nevada Division of Forestry are primarily used to determine mortality trends in the State from year to year. Mortality trends are described in terms of acres affected; however, not all trees on these acres are dead. Thus, an estimate of the number of trees killed is also provided. Not all forested lands are surveyed, and not all of the same acres are surveyed every year. Sometimes, tree mortality may be counted in the same area in consecutive years. This can lead to inflated estimates of actual tree mortality. Total acres tallied may also change between years due to increases or decreases in the total number of acres surveyed. Consequently, interpretation of ADS data should consider these sources of inconsistency Most of the area flown in 2012 was comprised of National Forest System (FS) and Bureau of Land Management (BLM) lands in eastern and central Nevada. The ADS data encompasses most of the Humboldt-Toiyabe National Forest including portions of the Bridgeport and Carson Ranger Districts located in California. A smaller percentage of acreage was surveyed to obtain data for Great Basin National Park, other federal lands, State lands, and private lands (Table 1).

TABLE1. TOTAL NUMBER OF ACRES SURVEYED IN EACH OF THE OWNERSHIP CATEGORIES FOR THE YEARS 2004 TO 2012 (INCLUDES CALIFORNIA ACRES SURVEYED AS WELL AS NEVADA ACRES).

Land Ownership/Year	2004	2005	2006	2007	2008	2009	2010	2011	2012
NF H-T (NV)	3924900	3697000	2508400	3739200	4757970	3998170	4340053	4008334	4011229
NF-HT (CA)	595000	531600	548000	560700	582000	551238	595850	582933	582933
BLM	1076400	1109000	712300	938600	1924990	2074498	2299901	1937082	1892996
private (NV)	298600	344300	153200	381900	440637	540760	360,865	519280	306606
private (CA within NF)	32600	31500	38000	36200	31800	28071	32335	41528	29846
Great Basin NP	76200	76700	77000	76900	75995	77005	76890	75604	75604
Other Federal*	42000	2900	10800	4500	41967	38530	1007	33228	33228
NV State Lands	17800	18000	3000	20100	17073	22113	20579	20105	17163
TOTAL	6063500	5811000	4050700	5758100	7872432	7330385	7727480	7218094	6949605

*Includes United States Fish and Wildlife Service, Department of Defense, Bureau of Indian Affairs, and other tribal lands

Long term insect trend data summarizes activity detected on all surveyed ownerships in NV and CA. However, the discussions of activity for individual insect and disease agents detected in 2012 are Nevada only and summarized on a county basis. The total number of acres in each county and the percentage of acres surveyed during 2012 are provided in Table 2.

TABLE 2 NUMBER AND PERCENTAGES OF ACRES SURVEYED IN NEVADA COUNTIES IN 2012

COUNTY	Total Acres in County	2012 Acres Surveyed	2012 % Surveyed
Carson City	103,569	47,857	46.2
Clark	5,176,177	220,145	4.3
Douglas	478,351	297,540	62.2
Elko	10,979,963	1,310,395	11.9
Eureka	2,663,738	201,809	7.6
Humboldt	6,219,557	274,118	4.4
Lander	3,534,543	304,339	8.6
Lincoln	6,782,623	13,576	0.2
Lyon	1,310,315	132,152	10.1
Mineral	2,462,989	0	0.0
Nye	11,686,348	1,939,598	16.6
Pershing	3,863,680	0	0.0
Storey	167,774	44,786	26.7
Washoe	4,234,009	198,342	4.7
White Pine	5,676,727	1,321,436	23.3
Total	65,340,363	6,306,093	9.7

In 2012, the amount of insect and disease-caused tree mortality generally decreased. This decrease can be attributed to a general trend of decline over the last few years and above normal moisture in 2010-2011. Adequate precipitation is necessary to maintain tree vigor and resistance to insects and pathogens. The western states, including Nevada, experienced below average precipitation in the winter of 2011- 2012 and again in the winter of 2012-2013 (Figure 1).

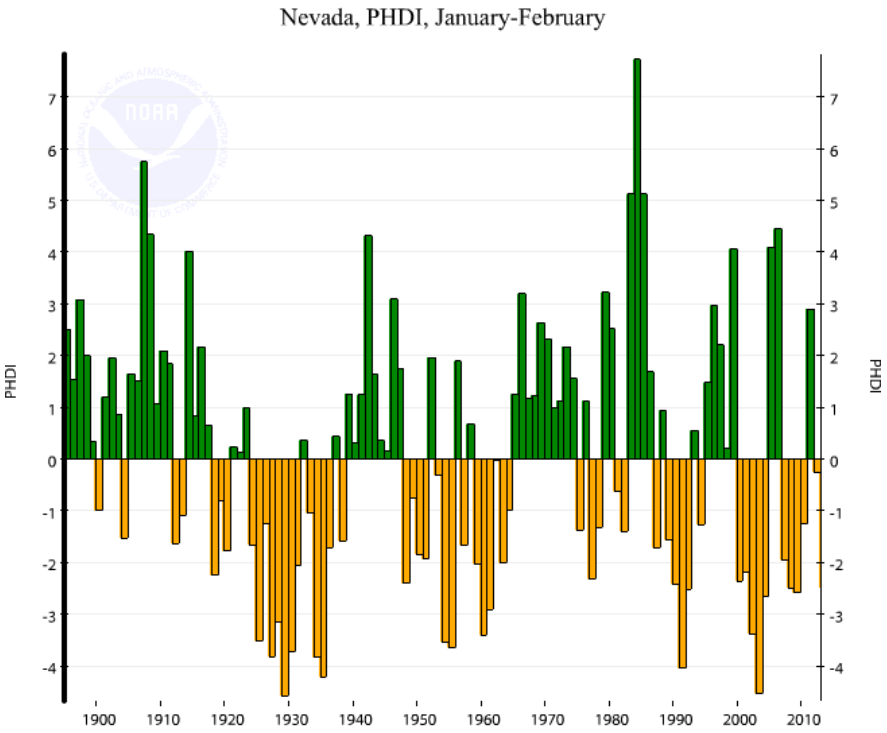


Figure 1 - National Oceanic and Atmospheric Administration (NOAA) Nevada Palmer Drought Severity Index –Z of January -February Precipitation from 1885-2013 (National Climate Data Center).

Most of the tree mortality noted in 2012 is attributed to bark beetle activity and/or past drought effects. Please note that some bark beetle-killed trees are not typically symptomatic (faded foliage) until one year following the year of attack. Therefore, the numbers of acres affected and trees killed by bark beetles, as recorded during ADS flights, are typically a reflection of the previous year's or earlier attacks. Levels of defoliation, however, may reflect either the activity of an insect or disease during the current year or activity since bud break. Most of the pinyon pine defoliation attributed to pinyon needle scale has been occurring for a few years, but was only visible from the air starting in 2009. In the winter of 2010-2011, above average precipitation caused a re-foliation of the pinyon and a general improvement in overall pinyon health, but the drought in the winter of 2011-2012 & 2012-2013, caused the defoliation to continue with increased mortality caused by twig beetles on the younger trees. Aspen and curlleaf mountain mahogany declines are largely attributed to successive years of drought in conjunction with stress/damage induced by other biotic and abiotic factors such as a late spring/early summer frost.

In 2012, Nevada mortality caused by most insects and diseases (number of trees killed) decreased from 2011 for the third year in a row. The exceptions of mortality agents that increased were: Jeffrey pine beetle increased 22% from 69 trees in 2011 to 89 trees in 2012 in western Nevada; and pinyon engraver beetle increased over 800% of 2011 figures with approximately 11,972 trees being affected

in 2012. This is most likely due to the widespread and long-term scale/sawfly infestations and a very dry 2011-12 winter season. Graphically it does not compare to the pinyon Ips outbreak of 2003-2005, but is a significant increase of the endemic levels of 2011 (Table 3).

TABLE 3. TREE MORTALITY ATTRIBUTED TO FOREST PEST THAT WAS AERIALLY DETECTED IN 2012 BY COUNTY[1]

	Mountain Pine Beetle White Pines[1]		Fir Engraver Beetle		Jeffrey Pine Beetle		Pinyon Engraver Beetle		Subalpine Fir Mortality Complex	
COUNTY	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres
Carson City	10	4	50	51	3	3	18	21		
Clark	10	6	10	5						
Douglas	3	1	6	4	35	24	7,468	1,223		
Elko	1,302	1,136	10	6			5	3	773	712
Eureka	0	0					79	54		
Humboldt	12	11								
Lander	40	21					235	114		
Lincoln	0	0					95	48		
Lyon	5	3					1,184	167		
Mineral	0	0								
Nye	378	735	66	95			1,082	546		
Pershing	0	0								
Storey	0	0					30	16		
Washoe	438	132	3	3	51	48	43	20		
White Pine	1,743	1,532	172	99			1,733	1,019		
Total	3,941	3,581	317	263	89	75	11,972	3,231	773	712

[1] Mountain pine beetle-caused tree mortality occurring in western white, whitebark, bristlecone and limber pines only and does not include lodgepole/ponderosa pine mortality. Mortality in lodgepole included 1 tree on 1 acre, in Douglas Counties, and 88 trees on 56 acres in Washoe Counties. Mortality in ponderosa included 22 trees on 11acres and 25 trees on 12 acre in Nye and White Pine Counties respectively, and 40 trees on 20 acres in Clark County.

In 2012, defoliators decreased for the most part with a few exceptions. Pinyon needle scale/sawfly decreased nearly 88% in 2012 with a total of about 570,282 acres (See 2012 ADS Damage Map-Page ii);. Douglas fir tussock moth on subalpine fir decreased to less than half: from 635 acres in 2011 down to 299 acres in 2012; and tent catepillar on aspen decreased over 33%: from 4,184 acres in 2011 to 1390 acres in 2012. On the other hand, mountain mahogany defoliation, due to drought, increased 24% to 6,916 acres from 5,256 acres in 2011, and aspen defolition/decline/dieback increased over 300%: from 9,543 in 2011 to 30,191 acres in 2012. Approximately 2247 acres of new Jeffrey and lodgepole pine needle scale defoliation was mapped in Washoe County. And slightly more than this was mapped in the adjacent California portion of the Humboldt Toiyabe National Forest, as well. This was the first year that the defoliation was visible from the air. In additon, a new outbreak of satin moth on aspen in locations throughout Nevada was observed and over 80 acres of nearly complete defoliation was mapped in western Nevada and reported in sites throughout northern Nevada (Table 4).

TABLE 4. INSECT DEFOLIATION AND ASSOCIATED DECLINE BY COUNTY IN 2012.

	Aspen Decline/Dieback	Forest Tent Caterpillar/Frost/Other defoliators on Aspen	Singleleaf Pinyon Pine Defoliation by Needle Scale & Sawfly	Curl leaf Mountain Mahogany Drought Damage
COUNTY	Acres	Acres	Acres	Acres
Carson City		155	12,044	
Clark		0	1,471	
Douglas	29	265	55,852	35
Elko	4,077	7,402	1,537	0
Eureka	228	664	32,955	437
Humboldt	495	2,263	-	
Lander	194	145	46,736	208
Lincoln		0	-	
Lyon	3	36	34,316	61
Mineral		0	-	
Nye	1,128	8,415	228,982	3,681
Pershing		0	-	
Storey		0	8,522	
Washoe	17	1,867	2,053	41
White Pine	148	2,660	145,814	2,453
Total	6,319	23,872	570,282	6,916

[2] Tables 3 & 4. Produced by G. Durham, Nevada Division of Forestry, using data provided by USDA FS Forest Health Protection.

Below is a summary graph showing the acres affected in Nevada by main mortality and defoliation agents aerially mapped in 2012. The majority of the damage was from defoliation of pinyon and apsen in 2012.

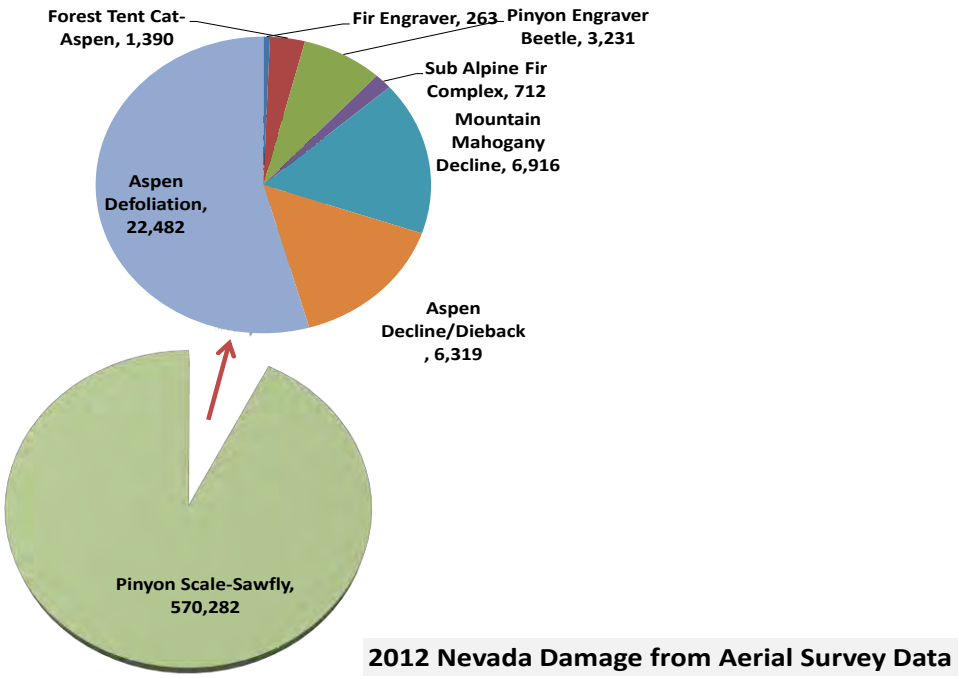


Figure 2 – Grahpic representation of the acres affected in Nevada by the main mortality and defoliation agents aerially mapped in 2012.

For additional information on forest insect and disease conditions and maps see:
http://foresthealth.fs.usda.gov/portal
and
http://forestry.nv.gov/forestry-resources/forest-health/

NOXIOUS WEEDS

Noxious weed species are widespread throughout Nevada. Nevada Department of Agriculture (NDOA) monitors and oversees Nevada's weed laws. Their main website for weed status, information, contacts, etc is:
http://agri.nv.gov/PLANT_NoxWeeds_index.htm

Below is NDOA's listing of Noxious Weeds in Nevada by Category A, B or C:

Common Name	Scientific Name
Category A Weeds:	
African Rue	Peganum harmala
Austrian fieldcress	Rorippa austriaca
Austrian peaweed	Sphaerophysa salsula / Swainsona salsula
Black henbane	Hyoscyamus niger
Camelthorn	Alhagi camelorum
Common crupina	Crupina vulgaris
Dalmation Toadflax	Linaria dalmatica
Dyer's woad	Isatis tinctoria
Eurasian water-milfoil	Myriophyllum spicatum
Giant Reed	Arundo donax
Giant Salvinia	Salvinia molesta
Goats rue	Galega officinalis
Green Fountain grass	Pennisetum setaceum
Houndstongue	Cynoglossum officinale
Hydrilla	Hydrilla verticillata
Iberian Starthistle	Centaurea iberica
Klamath weed	Hypericum perforatum
Malta Star thistle	Centaurea melitensis
Mayweed chamomile	Anthemis cotula
Mediterranean sage	Salvia aethiopis
Purple loosestrife	Lythrum salicaria, L.virgatum and their cultivars
Purple Star thistle	Centaurea calcitrapa
Rush skeletonweed	Chondrilla juncea
Sow Thistle	Sonchus arvensis
Spotted Knapweed	Centaurea masculosa
Squarrose knapweed	Centaurea virgata
Sulfur cinquefoil	Potentilla recta
Syrian Bean Caper	Zygophyllum fabago

Yellow Starthistle	Centaurea solstiltialis
Yellow Toadflax	Linaria vulgaris
Category B Weeds:	
Carolina Horse-nettle	Solanum carolinense
Diffuse Knapweed	Centaurea diffusa
Leafy spurge	Euphorbia esula
Medusahead	Taeniatherum caput-medusae
Musk Thistle	Carduus nutans
Russian Knapweed	Acroptilon repens
Sahara Mustard	Brassica tournefortii
Scotch Thistle	Onopordum acanthium
White Horse-nettle	Solanum elaeagnifolium
Category C Weeds:	
Canada Thistle	Cirsium arvense
Hoary cress	Cardaria draba
Johnson grass	Sorghum halepense
Perennial pepperweed	Lepidium latifolium
Poison Hemlock	Conium maculatum
Puncture vine	Tribulus terrestris
Salt cedar (tamarisk)	Tamarix spp
Water Hemlock	Cicuta maculata

Nevada Department of Agriculture (NDOA) began receiving USFS, State and Private Forestry grants in 2002. Working cooperatively with Cooperative Weed Management Areas (CWMA), they have been able to treat over 50,000 acres of noxious weeds statewide since 2002. Currently there are 37 Nevada CWMA's in the state. Each county in Nevada has at least one CWMA. In 2007, NDOA released bio-control agents for the following weeds and counties: spotted knapweed (Ely, White Pine County), Canada thistle (Gardnerville, Douglas County), and dalmatian toadflax (Pioche, Lincoln County). In 2011, Dalmatian toadflax and tamarisk leaf beetle collections and releases are being coordinated by Jeff Knight, State Entomologist. Tamarisk beetle (*Diorhabda elongate*) has now been observed south along Lake Mead and is as far as Overton. All state (Nevada) and Federal releases of *Diorhabda* have been stopped due to a legal agreement with USDA and another party.

INSECTS: NATIVE

DEFOLIATORS

Douglas-fir Tussock Moth
Orgyia pseudotsugata

Hosts: All true firs and spruce

The Douglas-fir tussock moth (DFTM) is an important native insect capable of causing significant defoliation of subalpine fir in Nevada. Heavy defoliation causes reduced growth, stress, and tree mortality. Heavy defoliation can cause top kill and mortality of advanced regeneration during a single season. Outbreaks are cyclic, usually appearing quickly followed by an abrupt decline within a one to four year period.

Figure 3 - Douglas-fir tussock moth larvae. Photo – from http://www.bugwood.org/

Less than half the DFTM defoliation of 2011 was detected during aerial surveys in 2012 in Elko County, Nevada. A total of 299 acres of mostly light defoliation was observed in the headwaters of Mill Ck off Jacks Ck in the Independence Mountains. Other pockets were found in the headwaters of the Jarbidge River, the headwaters of the West Mary's River, and at the headwaters of Flat Creek on the upper foothills of the Elk Mts. Two male moths were caught in traps in Jarbidge, NV in the Fall of 2012.

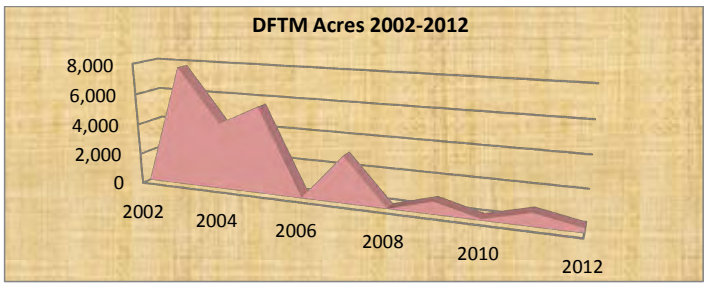


Figure 4 - Acres with Douglas-fir tussock moth defoliation in Nevada from 2002-2012.

Pinyon Sawfly
Neodiprion edulicolus

Host: pinyon pine

The pinyon sawfly is an important native insect capable of causing significant defoliation, but usually goes undetected because it occurs in small numbers and causes little damage. However, heavy defoliation causes reduced growth, stress, and tree mortality. Thin crowns adda ghostly, transparent appearance tothe forest canopy. In some locations, sawfly outbreaks are occurring in conjunction with pinyon needle scale (*Matsucoccus acalyptus)* defoliation.

In 2012, the outbreaks were very active in some of the same areas mapped as in 2011, but several new infestations were found in Nye and White Pine Counties. The acreage infested in 2012 increased significantly (830%): from 13,240 acres in 2011 to the 83,352 acres mapped in 2012. Much of this area was mapped as pinyon needle scale infestation in 2011. The re-foliation of the pinyon with the above average 2011 water year helped to mask some of the damage in some areas. However, after the drought year of 2012, areas that had been repeatedly defoliated are losing many of the smaller and some of the larger trees.

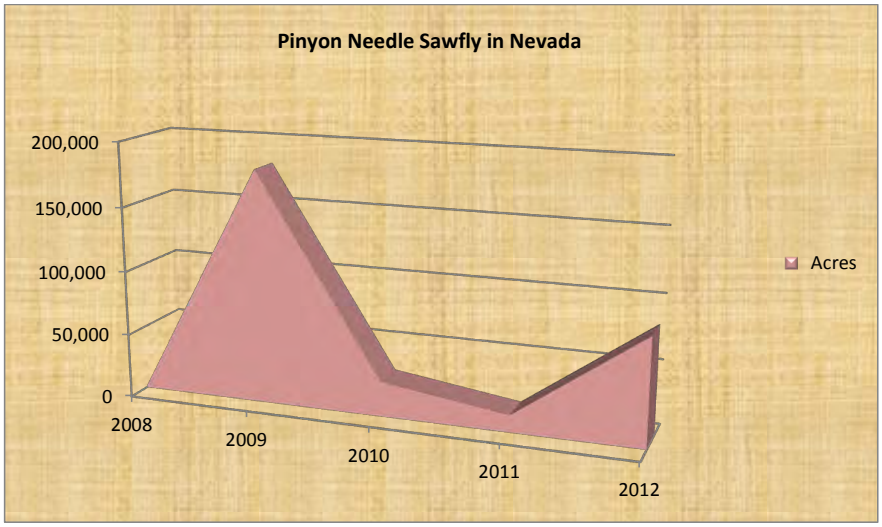


Figure 5 – Pinyon sawfly infested acres in Nevada from 2008-2012.

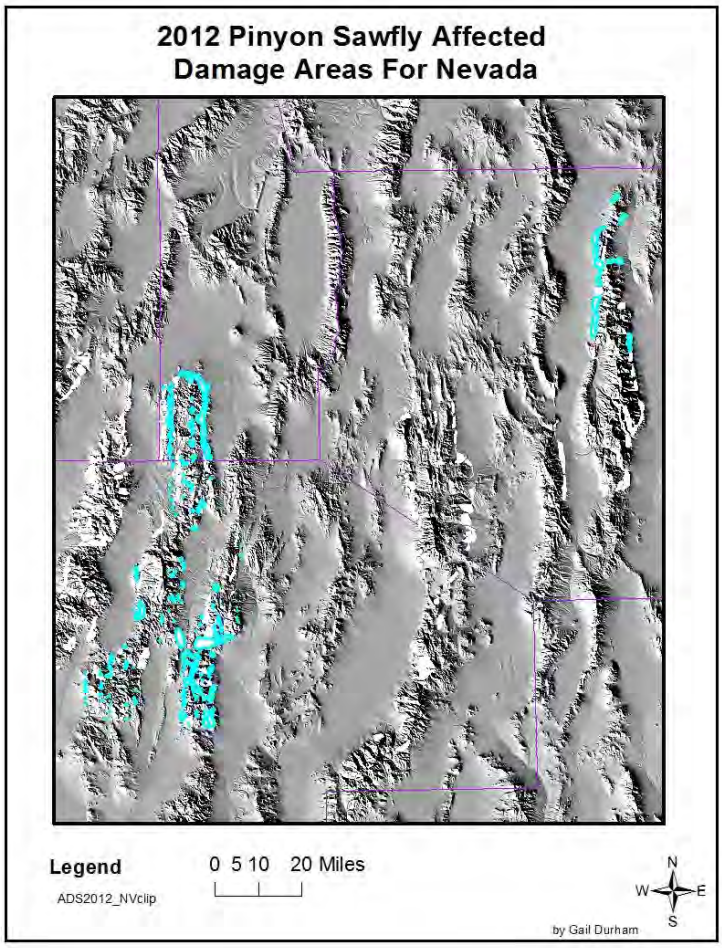


Figure 6- Map showing 2012 Aerial Detection Survey mapped pinyon needle sawfly damage.

Eureka County- 20,360 acres found at the lower elevations in southern Eureka County affecting the northeast end of the Monitor Range. This is nearly 270% of the acreage mapped in 2011.
Nye County – 44,829 acres of light defoliation found on throughout the Monitor and Hot Creek ranges. This is 15 times the acreage mapped in 2011.
White Pine County – 18,163 acres in multiple polygons on the north half of the Schell Creek Range. This is over 660% of the acreage mapped in 2011.

Pinyon Needle Scale
Matsucoccus acalyptus

Host: pinyon pine

The pinyon needle scale (PNS) is a sap-sucking insect that feeds on two year old needles. Foliage of infested trees turns yellow then brown. Heavy defoliation causes reduced growth, stress, and tree mortality. Past outbreaks have been recorded since 1959 throughout Nevada, causing localized defoliation and mortality of some trees. Historic outbreaks were noted in 1957-1963 in southeast Nevada and southwest Utah, affecting several hundred thousand acres. During 1969 and 1970, portions of the Humboldt-Toiyabe NF in California and Nevada were defoliated. A mild winter in 1969 was one of the many factors that triggered this severe outbreak. It was mostly the younger trees growing at lower elevations on alluvial fans that were affected. In 2007, a localized outbreak was found on Currant Summit on the border of Nye and White Pine Counties. In 2008, an area of 776 acres was found on the east side of the Schell Creek Mountains, in the low foothills north and south of Cleve Creek and north of Taft Creek in White Pine County. In 2008, more evidence of this infestation was found further south on the east side of Connors Pass on the Schell Creek Mountains.

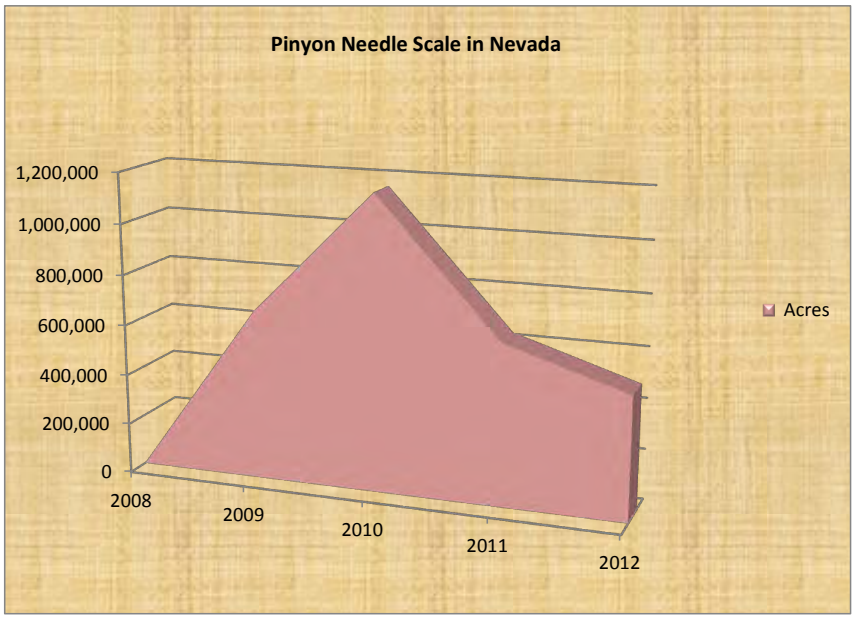
In 2009, approximately 7% of Nevada's mapped pinyon/juniper forest was affected by this insect with many areas also having very low levels of pinyon mortality attributed to pinyon *Ips* or other causes. Drought and scale defoliation likely exacerbated the pinyon mortality. The most severely affected areas were largely comprised of younger trees and occurred in the lowest areas of alluvial fans and hill slopes. In 2010, nearly 1,161,000 acres of the approximately 9,950,000 acres of pinyon in Nevada were mapped as scale-defoliated. At this point the scale was affecting trees in the mid-elevation range. This represented 11.6% of Nevada's pinyon forest. In 2011, the pinyon scale decreased to approximately half of the 2010 acreage, likely due to an above average precipitation year which caused a re-foliation event and an increase of predator/parasites, such as lady bugs and an unknown virus. The re-foliation significantly improved the condition of the trees in the higher elevation areas. Most of the 2011 damage was the lower elevation areas of 2010. In 2012, approximately 75% of 2011's acres of pinyon scale infestation was mapped at about 487,000 acres in NV. Many of the smaller trees in this area have died from severe defoliation and subsequent twig beetle damage (Figure 6). Much of the mapped area was also affected by a combination of insects such as twig beetles (*Pityophthorus spp., Pityogenes spp*.), and pinyon tip moth *(Dioryctria albovitella)* as well as *Matsucoccus monophyllae.* From the air, the damage caused by these other insects is similar in appearance to that of pinyon needle scale infestation, and some areas will be dominated by one or a mixture of these insects. Consequently, differentiating damage attributed to these various causal agents can be extremely difficult, and therefore are all mapped as pinyon-scale.

A. 

B. 

C. 

Figure 7 – (A) Top left photo of Berlin ichthyosaur State Park in 2007 before Pinyon pine needle scale infested the single leaf pinyon as shown on the top right photo of same general area in 2011 (note the see-through appearance of the foliage), and (B) nearly epicormic re-growth exhibited on the defoliated pinyon in the spring 2011(C) mature pinyon with heavy scale infestation in 2012 in central NV.


Pinyon Needle Scale in Nevada
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
2008
2009
2010
2011
2012
Acres

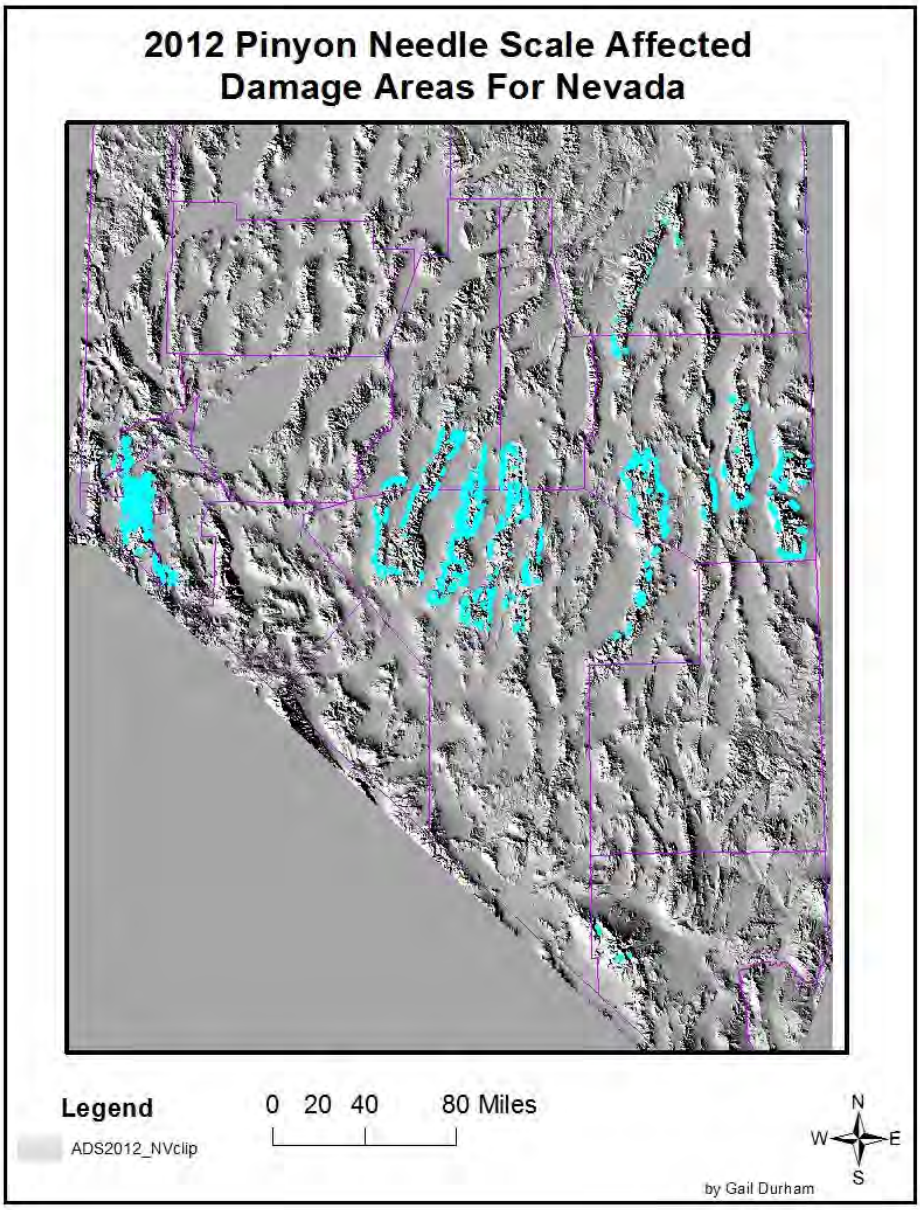


Figure 8- Pinyon needle scale (and other defoliator insect) damage in 2012.

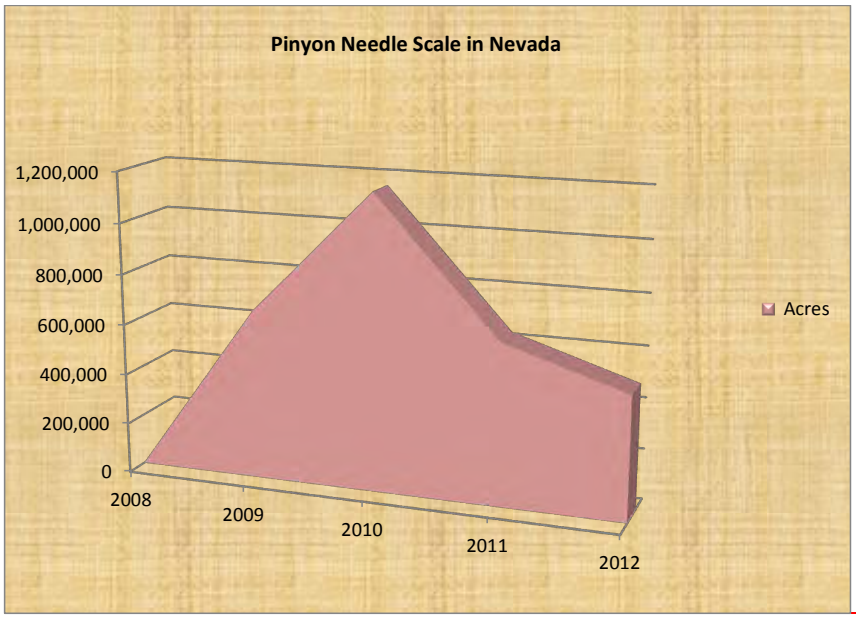


Figure 9 - Acres with pinyon pine needle scale in Nevada from 2008-2012.

Carson City – 12,044 acres occupying most of the woodlands on the lower alluvial fans and typically on the smaller trees of the Pinenut Mountain Range.
Clark County – 1,471 acres occupying mostly on the lower alluvial fans of the central Spring Mountain Range.
Douglas County – 55,852 acres throughout the Pinenut Mountain Range. Most of this defoliation was light to moderate. Many of the smaller trees are succumbing to this fourth year of defoliation and are being killed outright by needle scale, or in combination with other insects. The north end of the Sweetwater Mountains at the lower elevations is also lightly to moderately infested.
Elko County – 1,537 acres found in patches on the lower elevations of the southern end of the East Humboldt Mountains, a few patches on the lower slopes of the western and eastern Ruby Mountains, and a few small patches on the southwest end of the Ruby Mountains.
Eureka County- 12,595 acres found in large patches on the northern end of the Monitor Range.
Lander County – 46,736 acres found in large patches at lowest elevations of the Toquima and Toiyabe Ranges. This is a continuation from last year.
Lyon County – 34,316 acres on the southwest side of the Virginia Range, and on the northeast end of the Pinenut Mountains at the lowest elevations. Large stands of the lowest elevation pinyon on the northeast side of the Sweetwater Mountains including Sweetwater Summit area were still moderately infested.

Nye County – 184,153 acres throughout the lower elevations of the Antelope, Hot Creek, Monitor, Toquima, Shoshone, Toiyabe, Grant, Quinn, Horse and White Pine Ranges in large elevational band swaths.
Storey County – 8,522 acres in large patches on the lowest edges of the Flowery Range, on the northeast edges of the Virginia Range.
Washoe County – 2,053 acres in one low elevation band polygon just above Washoe City in the Virginia Range.
White Pine County – 127,651 acres in large patches at the lower elevations on the Schell Creek Mountains scattered along the lower elevations from Snowbank Creek south to Hwy 6 – Connor Pass , along south end of the Egan Range, scattered large swaths at the lowest elevations of the Egan Range, much of the lower elevation pinyon on the White Pine Mountains from Hwy 50 south to Currant Summit and throughout the Horse Range and Grant Range's west range and a few polygons on the south end of the Ruby Mountains. In addition, large patches were mapped on the Mt Moriah area of the Snake Range mostly on the west side from Dry Canyon south, and a couple of patches on the east side at the mouth of Horse Canyon and a swath on the southernmost area. On the southern Snake Range including Great Basin National Park area, PNS was mapped in large scattered polygons on either side of the range and all across the southern end of the range.

Pinyon Axil Scale
Matsucoccus monophyllae

Host: pinyon pine

In the spring of 2011, *M. monophyllae* was found on many of the singleleaf pinyon trees infested with pinyon needle scale in Western Nevada. Although it is impossible to differentiate from pinyon needle scale from the air, it is probably more widespread than just Western Nevada. Spring surveys for this insect would be necessary to determine their extent. Species taxonomically identified by Jeff Knight, Nevada State Entomologist in the Spring 2011 from collections by Gail Durham from the western Pinenut Mountains in Douglas County, NV. This insect was noted throughout Nevada in needle scale infested areas.

Comment [RDM-1]: What was the increase or decrease in activity for this agent?

Figure-10- *Matsucoccus monophyllae* in twig axil on M. acalyptus infested twig, May, 2011.

Figure 11 – M. monophyllae at the base of the needles on twig on M. acalyptus infested twig.

Forest Tent Caterpillar
Malacosoma disstria

Hosts: aspen, birch, oak, some maples, and other deciduous species

The forest tent caterpillar (FTC) is a native defoliator of aspen. Overwintering takes place as a fully developed embryo inside the egg shell. When they hatch in the spring, the larvae tend to migrate high in the tree where they feed on expanding flower and leaf buds. After bud break, larvae feed on the foliage, being most gregarious in their early life stages. The adult is a tan moth about 4 cm long with two dark brown, oblique stripes on each forewing. The caterpillar (the most often seen life stage) is mostly dark blue with wavy reddish brown lines and distinct white, keyhole-shaped markings down the back. Larvae feed in groups without making any webbing. (Western Tent Caterpillar makes the large webs found on chokecherry and are reddish brown caterpillars). Flight and mating activities begin late afternoon through most of the night. There is one generation each year. Parasites tend to keep the outbreaks of this insect cyclic and in check over time.

In 2012, the area of FTC defoliation decreased to 1,390 acres which was 33% of the 4,184 acres mapped in 2011. This mortality was observed in Elko, Lander, Nye, and White Pine Counties. This includes 1,282 acres of small patches in Elko County in the Bull Run, Independence, East Humboldt, and Ruby Mountains. A spot, totaling 34 acres, was mapped in Lander County at the north end of the Toiyabe Range south of Highway 50.

In Nye County, a small patch on the Toquima Mountains totaling 40 acres and in White Pine County 34 acres were mapped in the southern Schell Creek Mountains.

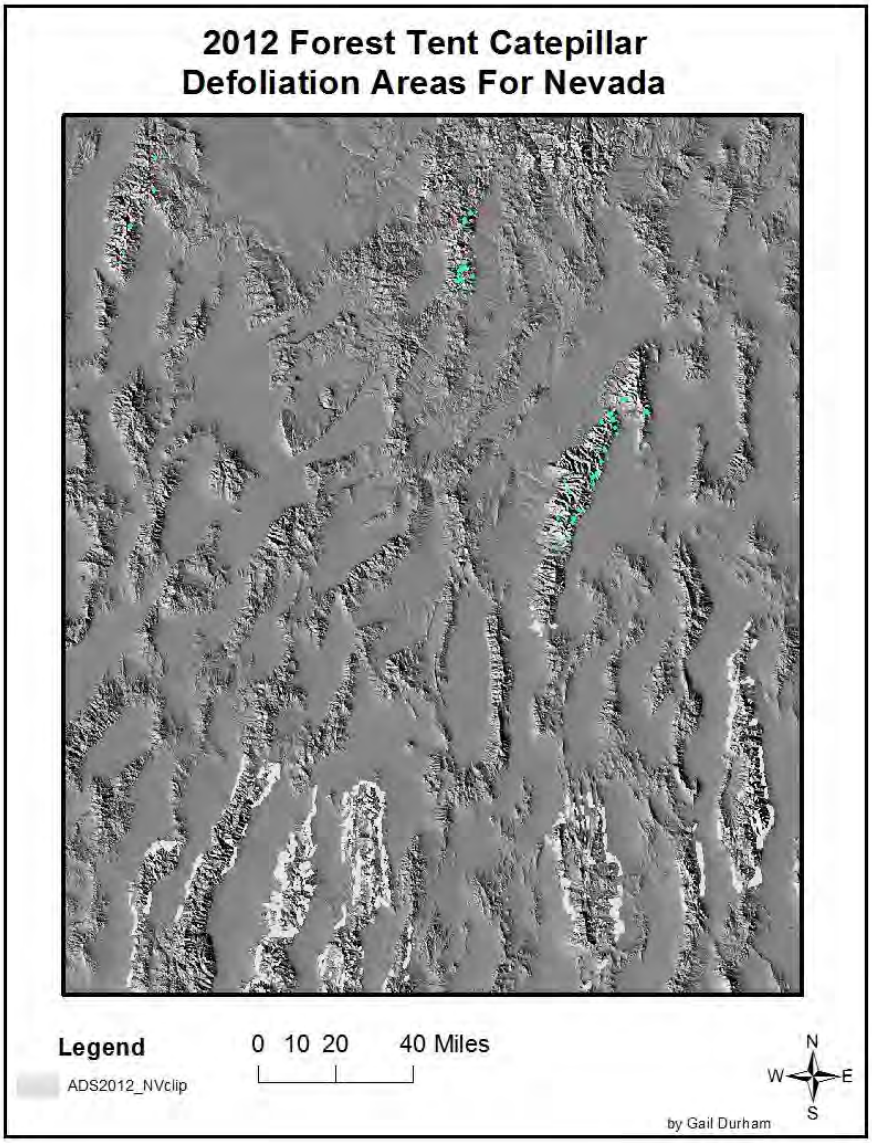


Figure 12– Areas of forest tent caterpillar defoliation of aspen in 2012

Unknown and Frost Damage

Hosts: aspen, willows, cottonwoods, and other deciduous species

Approximately 22,500 acres of unknown or frost damaged aspen was aerially mapped throughout northern Nevada in 2012. Much of the mapped area is in wilderness areas that are very inaccessible so the cause of the defoliation was not verified in the field in 2012.

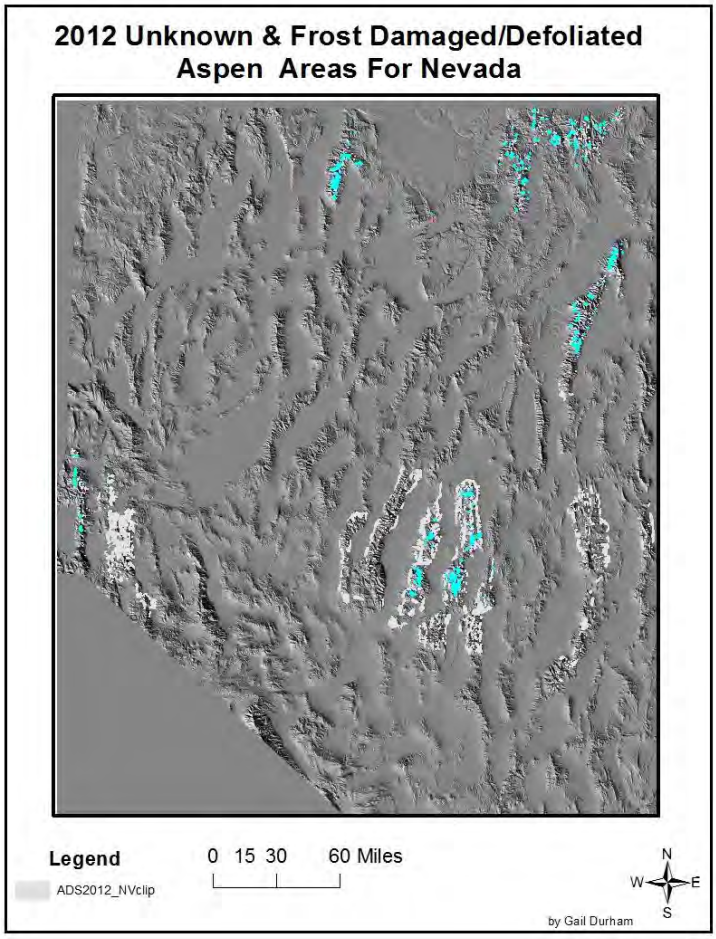


Figure 13 – Unknown and Frost damaged aspen areas mapped in 2012.

INSECTS: NATIVE

BARK BEETLES

Fir Engraver Beetle
Scolytus ventralis

Hosts: true firs

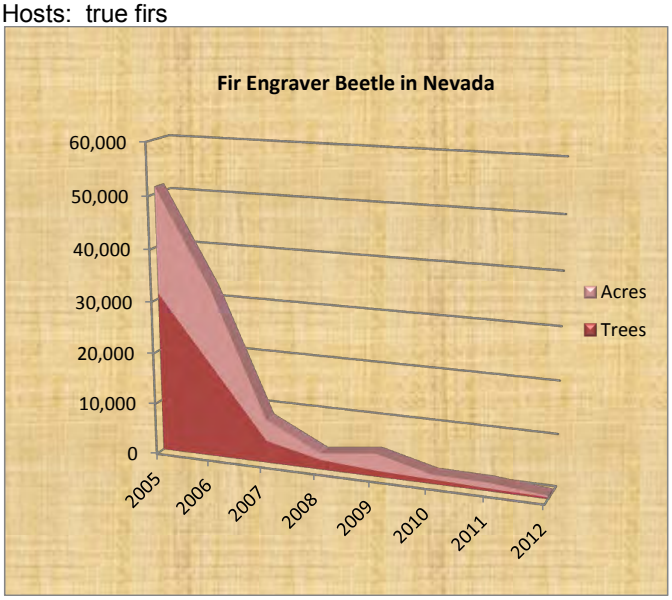


Figure 13- Fir engraver beetle damage areas and numbers in NV from 2005 - 2012

Tree mortality due to Fir-Engraver Beetle (FEB) continued to decrease in 2012 with beetles killing about 64 % of the number of trees that were killed in 2011. In 2012, 317 trees were killed on 263 acres (Figure 13).

For the tenth consecutive year, White Pine County had the highest amount of fir mortality with approximately172 dead trees scattered over about 99 acres. This represents a decrease to 38% of the 2011 mortality levels. Fir mortality increased in Carson City, remained static in Clark county, but decreased in Douglas, Washoe and White Pine counties in 2012.

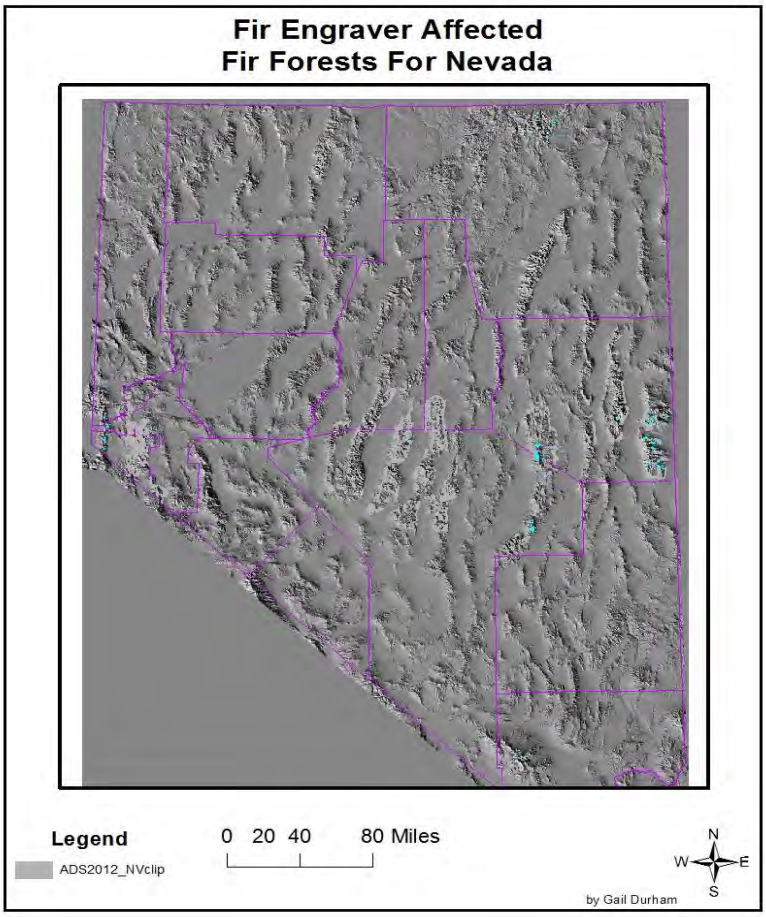


Figure 14 – Areas of mortality caused by the fir engraver beetle in Nevada in 2012.

Carson City – There were 50 trees mapped on 51 acre in 2012, a significant increase from 2011.
Clark County- Mortality was the same as 2011 at 10 trees were mapped on 5 acres in 2012.
Douglas County – Mortality decreased in 2012 to 6 trees killed on 4 acres in 2012.
Washoe County – Mortality decreased to a fifth of what was in 2011 with 3 trees were mapped on 3 acres in 2012.
White Pine County – Most of the mortality in Nevada was found again in this county- 172 trees mapped on 99 acres. However, this tree mortality is only about 38% of the number reported in 2011.

Jeffrey Pine Beetle
Dendroctonus jeffreyi

Host: Jeffrey pine

The Jeffrey pine beetle is the most destructive bark beetle of Jeffrey pine. Endemic populations usually attack scattered, slower growing, mature and over-mature trees and trees struck by lightning. In Nevada, Jeffrey pine is only found naturally along the Sierra Nevada Mountains. Field examinations of some of the mortality mapped in Alpine County, California revealed that some of the Jeffrey pine is also being killed by *Ips pini* in combination with roundhead and flathead woodborers. California Flathead Woodborer is also found as the main mortality agent on Jeffrey pine along the eastern front of the Carson Range in western Nevada.

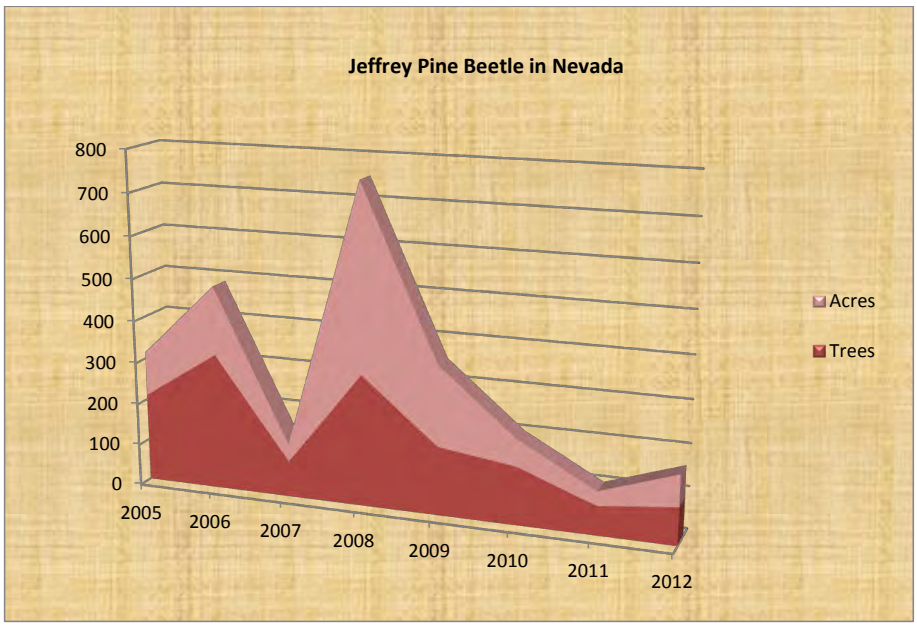


Figure 15 - Jeffrey pine beetle-caused tree mortality in Nevada 2005 - 2012

Figure 16 - Jeffrey pine beetle-caused tree mortality in Alpine county in California along Highway 88. (Photo: Sheri Smith)

In 2012, Jeffery pine beetle-caused tree mortality increased to 129 % of the trees observed in 2011, affecting 89 trees on 75 acres in Nevada (Figure 15). In Nevada, the mortality was predominantly in Washoe and Douglas counties with a small amount of mortality in Carson City county as shown on the map below (Figure 17).

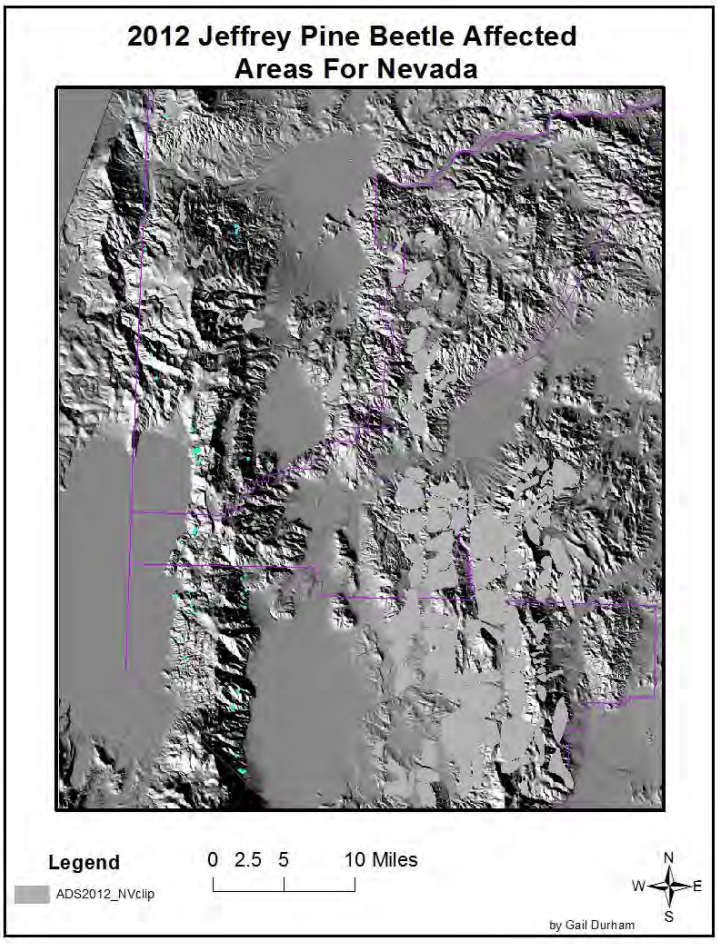


Figure 17 – Jeffrey Pine Beetle mortality in 2012 in Western NV and E. CA.

Carson City County –3 trees killed on 3 acres in 3 locations south and east of Secret Harbor.

Douglas County -35 trees killed over 24 acres scattered throughout the Carson Range with mortality found mostly in the upper-slope elevations and higher. Numerous small spots were mapped along the east shore of Lake Tahoe and at the lower elevations along the eastern side of the Carson range above Carson Valley. Some of these trees are most likely killed by California Flathead Borer (*Melanophila californica*), especially along the eastern Carson Range front, but it is impossible to differentiate from the air.

Washoe County – 51 trees killed on 48 acres were scattered in small spots east of Dog Valley area, in small spots SW of Reno, in the headwaters of Gray Creek, NNE of

Incline Village, multiple spots on the east shore of Lake Tahoe and a spot at the upper end of Musgrove Creek.

Mountain Pine Beetle
Dendroctonus ponderosae

Hosts: whitebark, bristlecone, limber, lodgepole, sugar, and ponderosa pine

Mountain pine beetle (MPB) can kill thousands of trees per year during outbreak conditions and millions of trees during extended epidemics in western forests. At endemic levels, MPB favors weakened, less vigorous trees with adequate phloem thickness to complete its life cycle. During epidemics, beetles may attack smaller diameter trees down to 4 inches diameter at breast height. Extensive mortality may alter large forest landscapes by converting pine forest ecosystems to grass and shrub landscapes for a period of 10-20 years. This conversion affects wildlife species, water yields and fuel loading.

In 2012, MPB-caused tree mortality in pines in Nevada generally decreased. Lodgepole pine tree mortality decreased to 89% of the amount reported in 2011. Limber pine, whitebark and bristlecone pine decreased 36% of the number of trees reported in 2011(Figure 18). Most of the Nevada mortality occurred in Elko and White Pine counties.

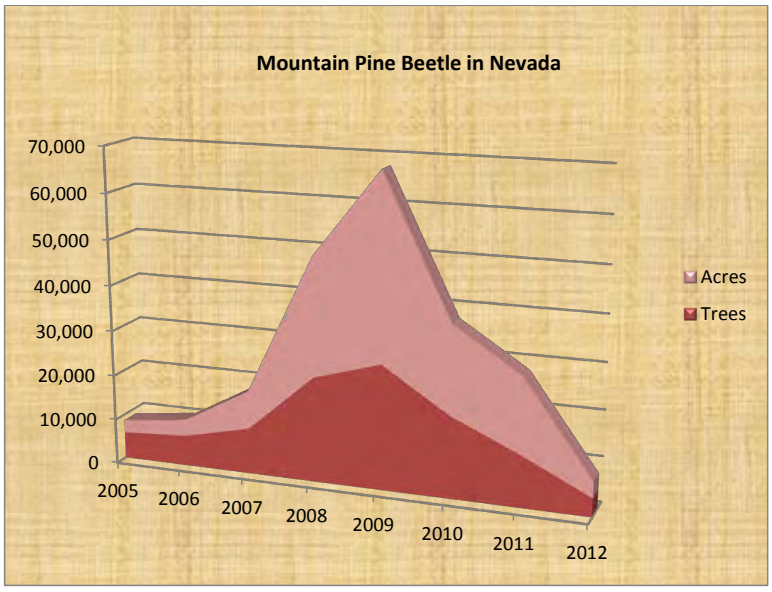


Figure 18 - Number of whitebark, limber, and bristlecone pine trees killed by mountain pine beetle in Nevada from 2005-2012.

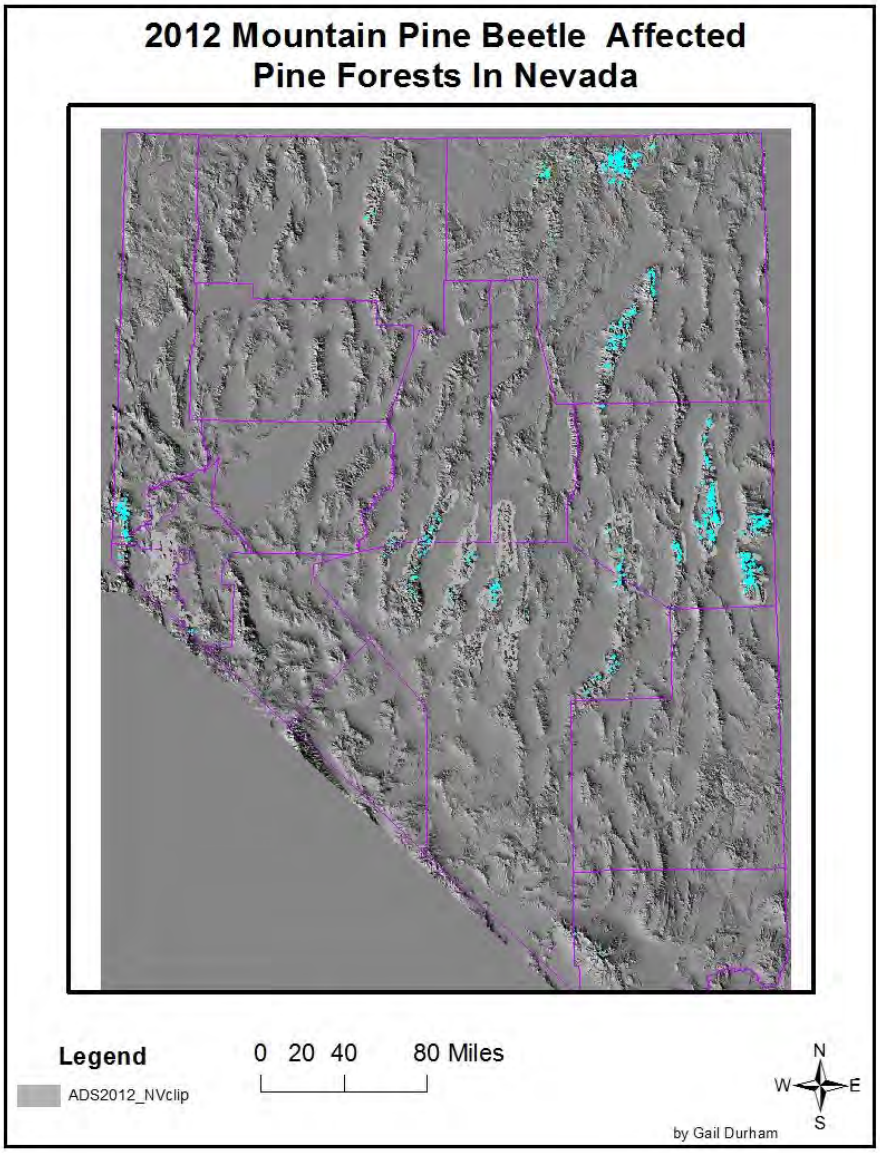


Figure 19 – Nevada and Eastern California Mountain Pine Beetle Mortality 2012 from Aerial Detection Surveys

Mountain Pine Beetle – Limber/Whitebark/Bristlecone/Western White Pine
In 2012, mortality of limber, whitebark, bristlecone and western white pines caused by MPB decreased to 3,581 acres and 3,941 trees, which is 22% of the 2011 acreage and 36% of the 2011 tree mortality. Most of the mortality occurred as small spots of up to five trees on tops of the mountain ranges surveyed.

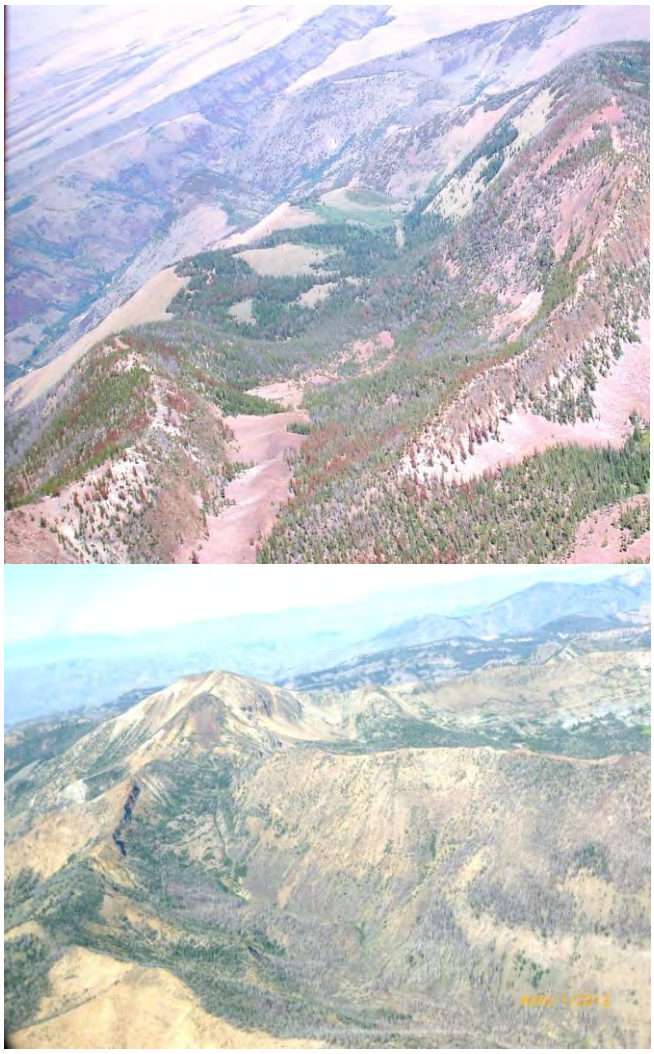


Figure 20. Mountain pine beetle-caused tree mortality in the Jarbidge Mountains moving down slope toward the town of Jarbidge, NV in August 2010 (on top) & 8/1/2012 (on bottom) showing the mostly dead pine in 2012 Photos: Gail Durham

Carson City County – Beetles killed 10 white pine trees on 4 acres west of Snow Valley Peak.
Clark County – Beetles killed10 white pine tree on 6 acres.
Douglas County – Beetles killed 3 white pine trees on one acre.
Elko County –153 limber pine and 220 whitebark pine trees were mapped on 220 acres and on 916 acres, respectively, in 2012. The amount of limber and whitebark pine mortality decreased to about 79% & 26% of what was mapped in 2011, respectively. There were large areas of whitebark pine mortality throughout the higher and mid elevations of the Jarbidge Mountains (Figure 19). Much of the whitebark host material has been killed in the Jarbidge Mts. There were small spots of whitebark pine mortality throughout the upper elevations of the Elk and Bull Run Mountains. Most of the limber and whitebark pine mortality in southern Elko County was scattered in small pockets at moderate elevations throughout the Ruby Mountains, on the northern end and eastern side of the East Humboldt Mountains. The Cherry Creek range was not mapped in 2012.
Humboldt County – Beetles killed 12 limber pine trees on 11 acres in spots throughout the Santa Rosa Mountains. This area was not mapped in 2011.
Lander County -40 limber pine trees were mapped on 21 acres (17% of 2011 mortality) in small to large patches along the upper elevations of the Toiyabe and northern Shoshone Ranges.
Lyon County – 5 whitebark pine trees were mapped on3 acres in two small spot around the Middle Sister Mountain in the Sweetwater Mountains. This is a tenfold decrease from 2011.
Nye County –378 dead white pine trees were observed on 735 acres. This is a decrease of 34% of the mortality of 2011. Most of it was found in numerous small to medium-sized spots mapped throughout the highest elevations of the Shoshone, Toiyabe, Toquima and Monitor Ranges with the vast majority of the spots in the Arc Dome, Alta Toquima, and Table Mountain Wilderness Areas. In addition, limber pine mortality was mapped in one spot on the Hot Creek Range north of Morey Peak, in five small spots on the south end of the White Pine Range and throughout the higher elevations of the Grant and Quinn Canyon Mountains.
Washoe County –438 white pine trees on 132 acres (10 times the 2011 mortality) were scattered in small spots throughout the higher elevations of the Carson Range, mostly northwest of Mount Rose.
White Pine County – 1,743 limber/ white pine trees were mapped on 1,532 acres. This represents a 41% and 18% decrease in white pine mortality, respectively. Most mortality was observed in small to medium-sized patches that were scattered along the tops of the Egan Range, throughout the Snake Range (including Great Basin National Park and Mt Moriah area), throughout the Schell Creek Range, one spot on the southern Ruby Mountains near Sherman Peak, and scattered throughout the White Pine Range.

Mountain Pine Beetle in Lodgepole Pine

In 2012, MPB activity in lodgepole pine in Nevada decreased by 90% of 2011 mortality figures with 89 dead trees on 57 acres.

Douglas County –1 trees mapped in1 acres in a spot just northeast of Skyland.
Washoe County –88 trees on568 acres were observed in small spots scattered throughout the Carson Range from north of Marlette Lake into the Mt Rose Wilderness area and east into Little Valley. Below is a graph showing the trap catches at Mt Rose Ski area for the summer 2012:

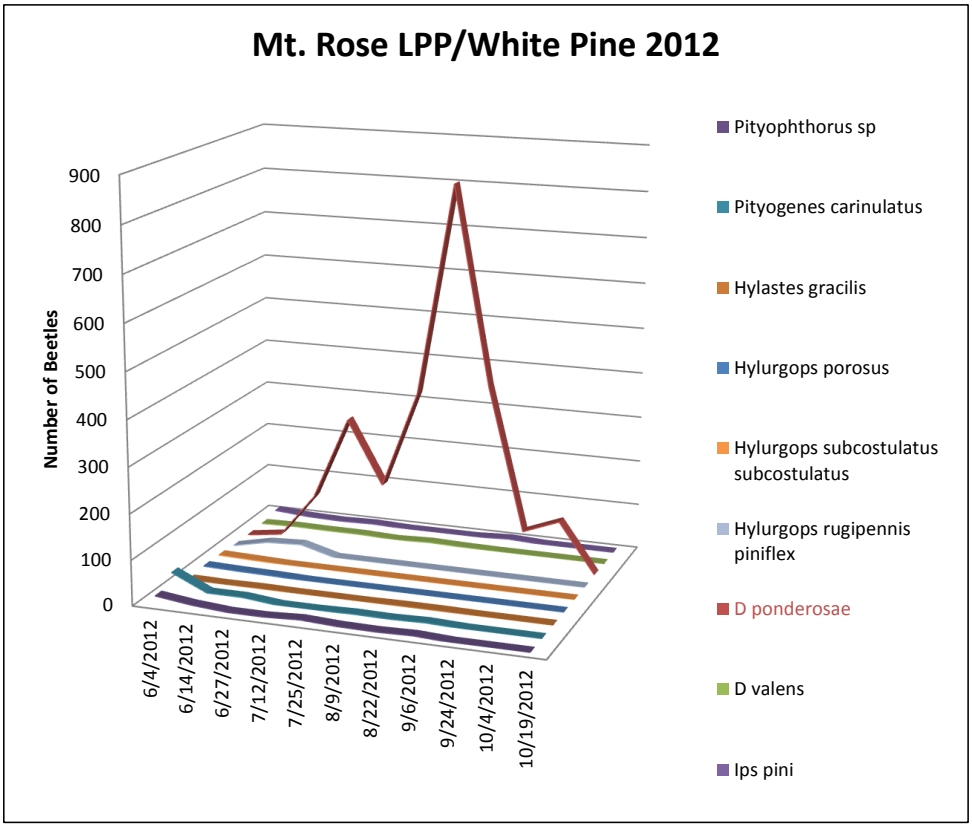


Figure 21 - Mt Rose Ski Area bark beetle trap catch data for summer 2012 with peak MPB catches from early-August to mid- September.

Mountain Pine Beetle/Western Pine Beetle in Ponderosa Pine

In 2012, ponderosa pine mortality decreased to less than half of 2011 levels. The mortality was found in three counties killing only 87 trees over 43 acres.

Clark County – 40 limber pine trees on 20 acres was attributed to MPB in 2012 mapping. This is about half of 2011 levels. Below are graphs showing the results from trapping in Kyle and Lee Canyons for various bark beetles. Most of the catches

were small twig beetles due to the installation of trap covers to prevent the interception of rare butterflies:

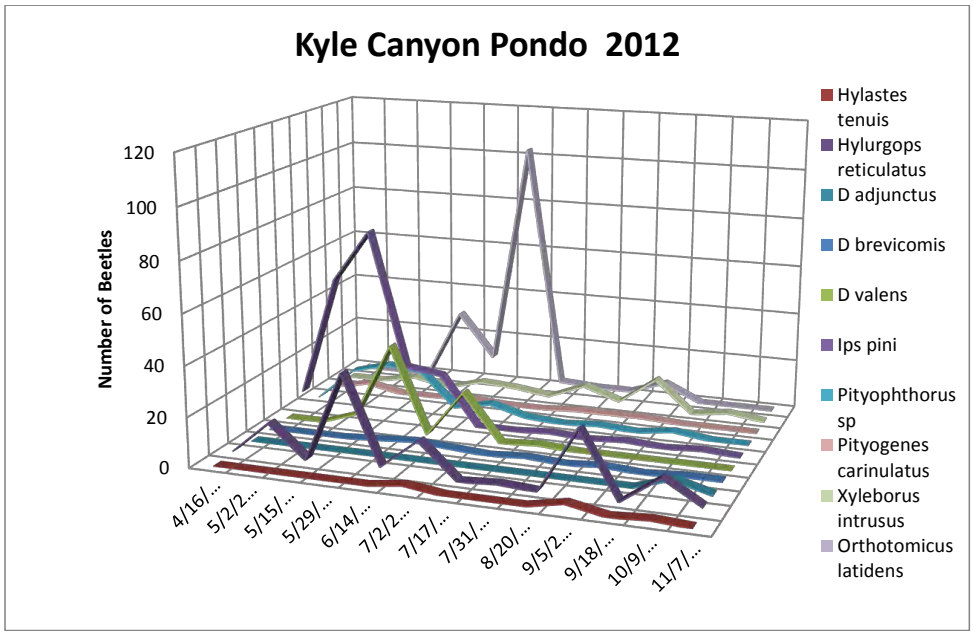


Figure 22- Kyle Canyon trap catches for the summer 2012 showing the dominance of *Ips pini* early in the spring and *Orthotomicus latidens* mid summer and very little *Dendroctonus* capture (part of this is most likely due to trap covers that had to be installed in early June) .

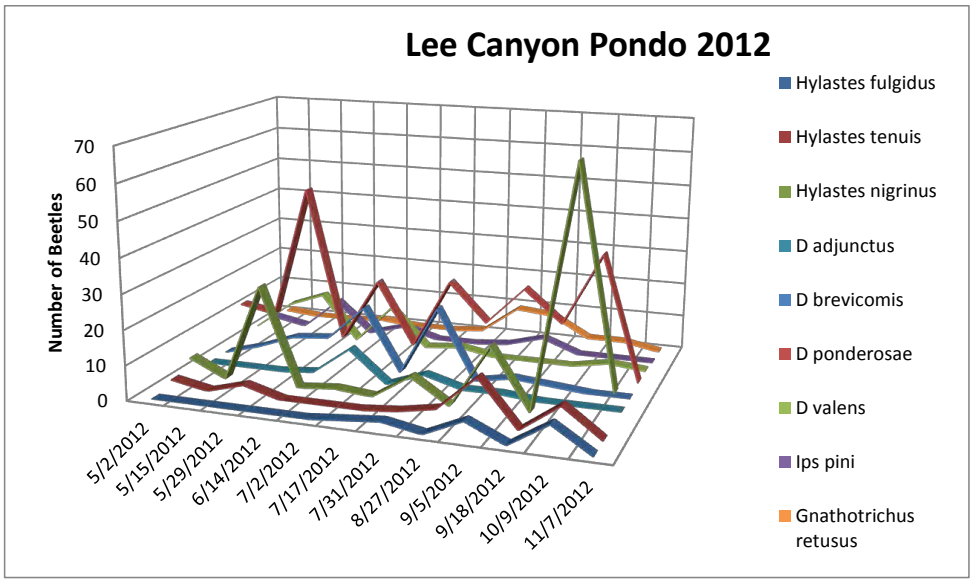


Figure 23 - Lee Canyon trap catches summer of 2012 showing the dominance of MPB throughout the season and WPB in mid-summer with *Hylastes nigrinus* dominating early summer and fall.

Nye County – 22 trees were mapped on 11 acre in two spots in the upper watershed of Horse Canyon in the western Grant Range.
White Pine County – 25 trees affected on 12 acres in the headwaters of Snake Creek of the Wheeler Peak Scenic Area, and the southwest corner of Miller Basin in the Snake Range.

Pinyon Engraver Beetle
Ips confusus
Host: single leaf pinyon

The pinyon engraver beetle (PEB) is a pest in pinyon-juniper ecosystems often affecting valuable home landscape trees. The insect produces multiple generations each year and consequently populations can build and spread rapidly.

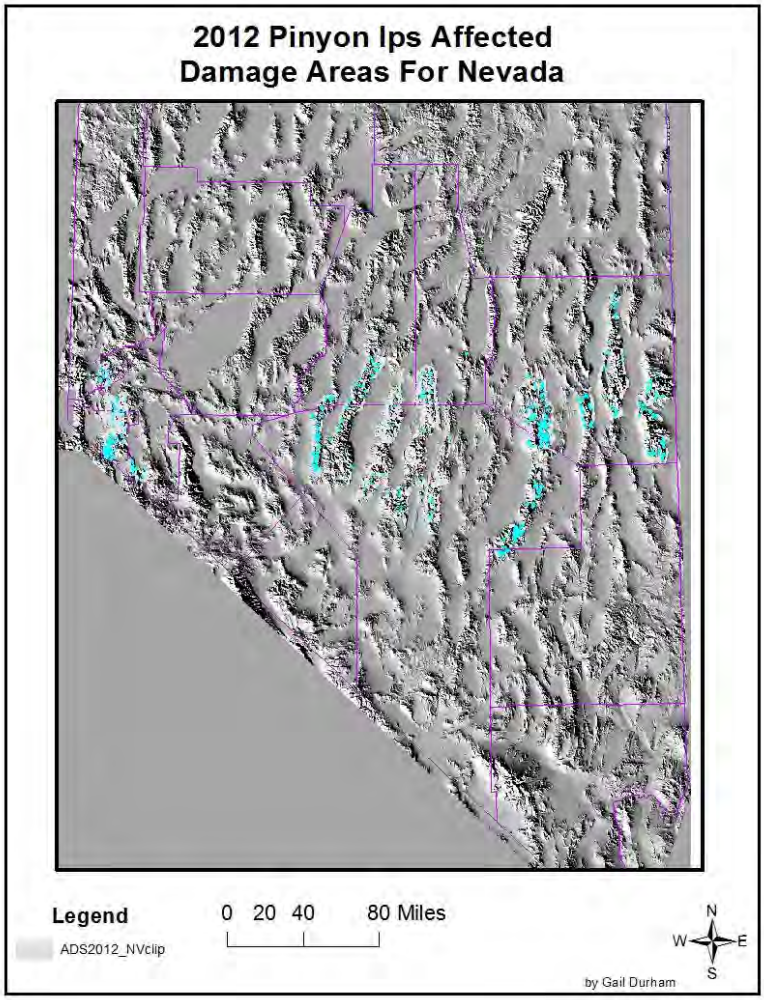


Figure 24 – Tree mortality caused by the pinyon engraver beetle in 2012 in Nevada.

Prior to 2003, pinyon pine was not frequently surveyed. In response to increasing concern of pinyon pine mortality in 2003, a multi-state effort was made to survey the extent of pinyon Ips-caused pinyon mortality. Approximately 3 million of the estimated 9.9 million acres of single-leaf pinyon that occur in Nevada were surveyed in 2003. In 2004, approximately 3.5 million acres of pinyon-juniper woodlands were flown and pinyon Ips-caused mortality of single leaf pinyon increased again. In 2005, 2006 and 2007, a dramatic decrease of pinyon mortality was seen within the surveyed area, in twelve counties. Although this mortality increased in 2009 up above 2006 levels, it did not represent a significant increase and in 2010 and 2011, it decreased back down to near 2008 endemic levels (Figure 25).

In 2012, 11,972 trees were infested by pinyon Ips, affecting over 3,231 trees. This represents 840% of the 2011 pinyon pine mortality figures (Figure 25). In 2011, eleven counties had recorded mortality from pinyon ips. Foresters in Lincoln county reported that the Mount Wilson Range was affected (this range was not surveyed in 2012). Douglas County had the greatest number of trees killed (7,468 trees, 62% of the state total). Most of this new mortality is associated with the affects of the past years of drought and the large pinyon needle scale and pinyon sawfly outbreaks across the state.

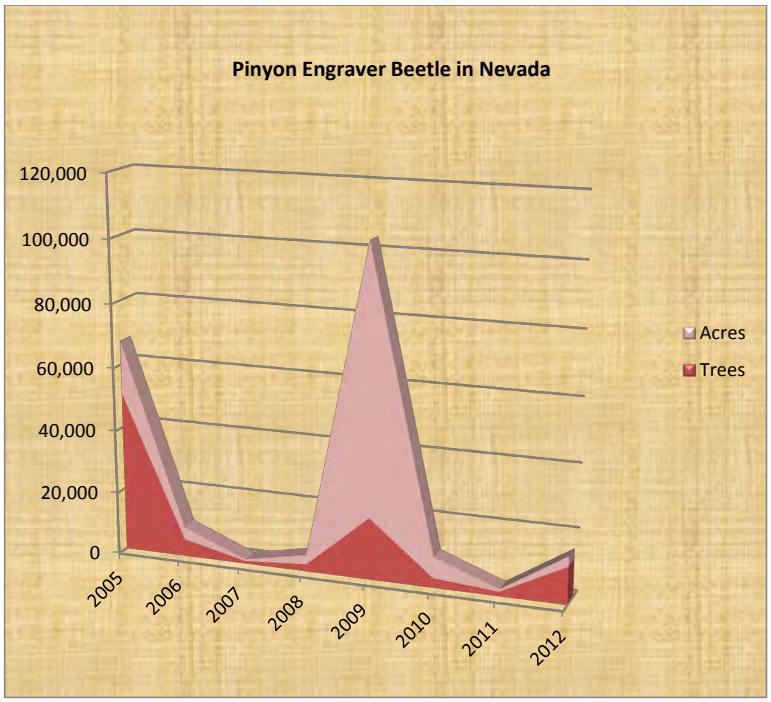


Figure 25 - Number of pinyon pine killed and acres of pinyon engraver beetle in Nevada and from 2005-2012.

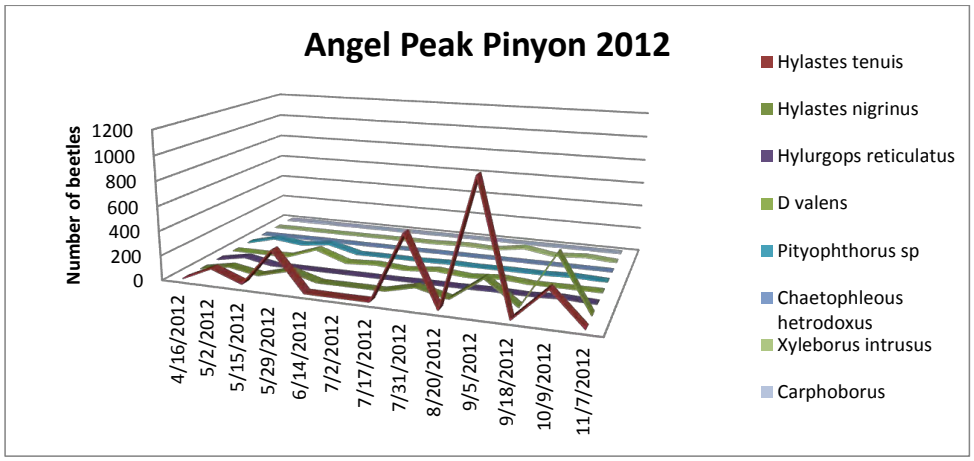


Figure 26 – Angel Peak Pinyon Ips traps, Spring Ms, Clark County catches summer 2012 showing a dominance of *Hylastes tenuis* in the spring and mid to late summer with *H. nigrinus* dominating late fall. Very little Ips confusus was caught in these traps in 2012.

Carson City County – Pinyon mortality decreased to 21 acres with18 trees in small spots associated with the pinyon scale outbreak and in the Pine Nut Range.
Clark County – There was no mapped mortality, in 2012. Traps set up in the mid-elevational pinyon juniper woodland on Angel Peak ridge and only 3 PEBs were caught with the Ips lure on 5/2/2012, but other small beetles were dominant as shown in Figure 26
Douglas County –7,468 trees killed over 1,223 acres in many scattered spots throughout the Pine Nut Mountain Range from California border north into Lyon County and Carson City County border
Elko County – 5 trees were mapped on 3 acres in a small spot mostly on the eastern Ruby Mts above Rock House.
Eureka County – Decreased to 79 trees on 54 acres. Mortality occurred in scattered, small spots at the lower elevations of the Monitor Range, especially in the areas heavily hit by pinyon needle sawfly.
Lander County – 235 trees were mapped on 114 acres in scattered spots in the northwest Shoshones, northern Toiyabes and north Toquima Ranges.
Lincoln County – 95 trees were mapped on 48 acres in scattered spots in the northwest Shoshones, northern Toiyabes and north Toquima Ranges.
Lyon County –1,184 trees on a total of 167 acres of scattered small spots of mortality in the northeast Pine Nut Range.
Nye County 1,082 trees were observed on 546 acres of scattered spots in the Grant and Quinn Canyon Range, Hot Creek, Monitor, Toquima, southern Toiyabe and Shoshone Mountains.

Storey County – Increased to 16 acres with 30 trees mapped in the Virginia Range in six spots scattered in the Virginia Range.
Washoe County – 20 acres with 43 trees was mapped in seven small spots throughout the western portion of the Virginia Range.
White Pine County – Mortality was mapped on 1,019 acres with 1,733 trees killed. Much of the mortality was associated with older pinyon needle scale on the west side of the Moorman Mountains and eastern White Pine Range. Mortality was also observed scattered on the Ward Mt area, Eagan, Snake and Schell Creek Mountains.

Pitch Mass Borer
Dioryctria spp.

Hosts: Singleleaf pinyon, ponderosa pine, Jeffrey pine

In the larval stage, *Dioryctria spp.* bore into the cambium of the trunk, branches, and shoots. This borer kills lateral branches and treetops of singleleaf pinyon and Jeffrey pine. With prolonged drought, this injury has weakened pinyon trees sufficiently to allow pinyon engraver beetle to successfully attack and kill pinyon pine trees. Pitch mass borer is found throughout the state of Nevada in most counties with singleleaf pinyon. The heaviest concentrations seem to occur in western Nevada where it also affects Jeffrey and ponderosa pine. Many young Jeffrey pines on the east slope of the Carson Range that came in after fires have been affected by this insect. In 2006 several entomologists, pathologists and foresters conducted a pinyon blister rust (*Cronartium occidentale)* search through the central portion of Nevada. They noted that pitch mass borer frequently uses rust cankers as an entry point (Figure 27). The rust and borer are found extensively across the state but are not mapped by ADS.

Figure 27 - Pitch mass borer infesting pinyon pine infected with pinyon blister rust.

TWIG INSECTS

Pinyon Tip Moth
Dioryctria albovitella

Host: Singleleaf pinyon

The pinyon tip moth causes tip killing, branch flagging, and stunted growth. Larvae of this small gray moth feed in the tips of branches killing new shoots and giving the tree a conspicuous scorched appearance. Pinyon tip moth is found throughout Nevada wherever singleleaf pinyon occurs. In 2009 through 2011, this insect was found commonly in the areas with heavy scale infestations. In 2007, a large outbreak, over hundreds of acres, was noted throughout the lower elevations of the east side of the Wilson Creek Mountains west of Camp Valley Creek, and south of Pine Creek (Figure 28). This moth is still active in Nevada and is mixing in with the pinyon needle scale in many of the infested areas of Nevada in 2011.

Figure 28 –The gray hazy appearance of pinyon tip moth damage as seen from the air (throughout bottom photo) and on the ground (top photo) on the west side of Camp Valley Creek south of Pine Creek in 2007.

INSECTS: NON-NATIVE

White Satin Moth
Leucoma salicis (L.)

Hosts: aspen, willows, cottonwoods, and other deciduous species

The white satin moth (WSM) is a non- native defoliator of aspen in the family of tussock moths (*Lymantriidae*). WSM is native to Europe and Asia. This is the same family gypsy moth and Douglas fir tussock moth are found in. It was introduced into North America in

British Columbia in 1920. It is currently distributed from Newfoundland through eastern Canada, northeastern US and from BC to northern California and in 2004 found in southwest Wyoming. It is now been found in spots throughout Northern Nevada. Overwintering takes place as a second-instar larvae which seek out hibernation sites on the trunk or branches of a host tree and molt after spinning silken coverings (hibernacula) which are hard to see because they are covered with bark, mosses and other detritus. When they emerge in May they feed on the young new leaves. This feeding continues until late June to early July and the larvae go through five to 6 more instars until they are approximately 3.5 – 4.5 cm long.. The caterpillar (the most often seen life stage) is mostly grayish brown with a dark head and back, but what stands out is the one row of large oblong white to pale-yellow patches down the middle of the back and two yellow lines sub-dorsally. The two lateral and sub-dorsal rows of orange tubercles have tufts of long brown hairs attached. These larvae spin cocoons in the leaves to pupate into shiny black, 1.5 to 2.2 cm long pupae with tufts of yellow hair. In July and August the adult moths emerge. The white adult moth about 2 - 4 cm long have no markings on the wings; the bodies are black and covered with white silky hairs that only allow glimpses of black beneath. See Figure 29 photos below:

Figure 29 – White satin moth larvae (top left); female white satin moth (top right); egg mass (bottom left); and complete defoliation of aspen in North Canyon, Spooner State Park, NV2012 (bottom right) (photos by Jeff Knight, State of Nevada Entomologist, NV Dept. of Agriculture)

In 2012, the area of WSM defoliation in Nevada mapped was approximately 70 acres in Washoe County in North Canyon of Spooner State Park and in Little Valley just west of and above Washoe Valley. Defoliation of aspen was noted in the Lake Tahoe Basin due to WSM in 1998-99 but in a very small area around the eastern shore just above Marla Bay, but not to the extent seen in 2012. Over 70 acres of WSM were mapped in the Carson Range in spots from Mogul Peak south to North Canyon in Spooner Lake State Park. More occurrences were reported from the top of Kingsbury Grade in Douglas County, the north end of the Shoshone Range south of Battle Mountain 20 miles and in northern Washoe County.

European Gypsy Moth
Lymantria dispar

Hosts: various deciduous species

In 2011, gypsy moth was surveyed by Nevada Department of Agriculture (NDOA). Trapping was conducted from May 3rd to November 16th . In all 697 traps were placed in 16 counties; all traps were negative. The last identified adult male was discovered in an RV park in Winnemucca in 1999.

Figure 29 - Adult gypsy moths; female above; male below, Photo: USDA APHIS PPQ archive, www.bugwood.org.

Red palm weevil
Rhynchophorus ferrugineus

Hosts: various palm tree species

Red palm weevil (*Rhynchophorus ferrugineus*), South American weevil (*Rhynchophorus palmarum*), and Silky cane weevil (*Metamasius hemopterus*) were surveyed for using a modified bucket trap baited with pheromone and fermenting fruit. In all, 12 traps were placed in Clark County; all traps were negative.

Mediterranean Pine Engraver Beetle **(MPE) and** Red Haired Bark Beetle **(RHBB)**
Orthotomicus erosus and Hylurgus ligniperda

In 2007, Nevada Dept. of Agriculture placed 58 Lindgren traps in 10 Nevada counties along with five Colossus traps placed in Washoe and Lincoln counties for various wood borers, MPE, and RPBB and did not capture any. None have been found in Nevada to date. Steve

Seybold and Jana Lee of the FS Pacific Southwest Research Station and the University of California Davis checked for these beetles in Las Vegas in March 2007 and found neither beetle in their prime habitats.

Exotic Wood Borers including: Scolytinae/Sirex Wood Wasp (Sirex noctillo), Asian Longhorn Beetle (Anoplophora glabripennis), and Emerald Ash Borer Beetle (Agrilus planipennis)

Hosts: various species

In 2011, The Nevada Department of Agriculture NDOA conducted funnel trapping for exotic wood borers using EDRR style trapping methods and sites (30 traps total) surveyed in 6 counties. Samples are currently being processed.

In 2009, The NDOA and the Nevada Division of Forestry cooperatively completed the Early Detection and Rapid Response (EDRR) bark beetle survey of the state for 2009. Nine sites were selected for their proximity to a possible pathway for introductions and for their representation of local forest conditions. Over 4,700 specimens were screened by the State Entomologist. Three new state records of scolytids resulted from the survey. They were cedar (juniper) bark beetle (*Phloeosinus serratus)*, fir root bark beetle (*Pseudohylesinus granulatus)*, and European shothole borer (*Anisandrus dispar)*. Representative specimens of these and numerous other scolytids are being incorporated into the reference collection at the Nevada Department of Agriculture. There also appears to be several new state records for cerambycids, buprestids and other beetles that have yet to be confirmed.

In 2011, all Emerald Ash Borer (*Agrilus planipennis*) trapping and data collection was performed by two NDOA part time seasonal employees with the cooperation of USDA/PPQ personnel in the Las Vegas and Reno areas. Trapping was conducted from May 3rd to November 16th. One hundred and five traps were placed in 3 counties; all traps were negative.

European Pine Shoot Moth (EPSM)
Rhyaclonia buoliana

In 2007, NDOA trapped for EPSM with 141 traps in 9 counties in 2007. Four traps were positive in Douglas County in 2006 and one trap was found positive in Washoe County in 2007. There was no activity in 2011.

Light Brown Apple Moth
Epiphyas postvittana

In 2010, Trapping was conducted from May 3rd to November 16th. Six hundres traps were placed in 10 counties; all traps were negative. In 2011, there was no activity.

Japanese Beetle
Popillia japonica Newman

In 2008, 545 traps were placed in 16 counties with the majority concentrated in the greater Reno and Las Vegas metropolitan areas**.** This was an increase of about 150 traps from last year. No Japanese beetles were found in 2008 or 2007.

In 2011, 80 traps were placed in four counties. All were negative. NDOA is carefully watching infestations in several other western states.

Walnut Twig Beetle
Pityophthorus juglandis

In 2012, Steve Seybold (USDA FS PSW Station) and Gail Durham (Nevada Division of Forestry) set up Walnut Twig Beetle (WTB) traps on private lands in Douglas County, NV where known populations of WTB were found on black walnut trees, *Juglans nigra* . Traps were also set in Washoe County, NV in cooperation with the State Entomologist, Jeff Knight. Gail and Jeff collected trap catches throughout the spring, summer and fall for Steve. Walnut twig beetle and its galleries were found in walnut trees in Reno, Carson City, and Genoa, Nevada. *Geosmithia morbida* and hence, thousand canker disease has been associated with the beetles in Douglas County, NV.

Figure 30 – Walnut twig Trap series set in Genoa, NV, Spring, 2012 by Gail Durham and Steve Seybold to determine trapping efficiency by trapping distance from walnut tree.

STATUS OF DISEASES

Stem and Branch Diseases

Dwarf Mistletoes
Arceuthobium spp.

Hosts: Douglas-fir, pines, true firs, and single-leaf pinyon

Dwarf mistletoes (DMT) are the single-most damaging agents of coniferous trees. These parasitic plants remain the most widespread and frequently observed disease within the state. Profusely branched, dense masses of host branches called “witches brooms” are often observed. Heavy dwarf mistletoe infestation can predispose trees to attack by insects and other diseases, reduce incremental growth, affect the forest canopy structure, lower resistance to drought, affect production of seed, and affect recreation and aesthetics. Since dwarf mistletoe infests trees of all ages, infestation problems may exist in secondary growth and regeneration, as well as mature and overmature tree stands.

Dwarf mistletoe on pinyon pine can be found throughout the state, but it has never been comprehensively surveyed. The State Forest Health Specialist has found DMT from the Spring Mountains in the south and north through the Toiyabes and east and west to both borders of the state. Pinyon engraver beetle-caused mortality was observed in some of the heavy dwarf mistletoe infected pinyon pine stands around the state of Nevada. In the spring of 2013, after two consecutive drought years, some of the dwarf mistletoe-weakened trees have succumbed to pinyon engraver beetle attacks.

Currently, fuel reduction activities are being undertaken in heavily DMT infested stands of pinyon pine in western Nevada. The treatments are intended to create a buffer between non-infected stands and infected stands to prevent the spread of this disease (Figure 31). This type of treatment can be effective, due to the primarily short range spread mechanism of dwarf mistletoes.

Ponderosa and Jeffrey pines are often found heavily infected with western dwarf mistletoe (*A. campylopodum*) and then are attacked by Ips, flathead borers, Jeffrey pine beetle, and western pine beetle as well as other agents, especially during prolonged drought periods. Additionally, true fir nfected with dwarf mistletoe are commonly attacked by fir engraver beetle, or experience branch dieback due to Cytospora canker. In 2011, limber pine dwarf mistletoe (*A. cyanocarpum*) was found infecting whitebark and limber pines on the East Humboldt and Ruby Mountains in 2011 predisposing them to attack by mountain pine beetle in those areas.

Figure 31 – A. cyanocarpum infecting whitebark pine in Lamoille Canyon in the Ruby Mts and on limber pine at Angel Lake in the Eastern East Humboldts and subsequently being killed by mountain pine beetle.

Pinyon Blister Rust
Cronartium occidentale

Host: singleleaf pinyon pine

An informal survey of central Nevada by various FS pathologists and entomologists as well as BLM and Nevada State Foresters revealed that the disease is prevalent throughout the state. It attacks and kills small trees (Figure 32) and causes branch flagging on larger more resistant trees. Many of the rust infections were attacked by pitch mass borer. This disease is mainly found in a band between 6000 and 7000 feet of elevation near drainages that are suitable for the alternate host (*Ribes* spp.).


Figure 32- Singleleaf pinyon pine that is infected with pinyon blister rust near its base.

White Pine Blister Rust
Cronartium ribicola

Hosts: limber, bristlecone, whitebark, sugar, and western white pine

White pine blister rust (WPBR) has been observed in western Nevada on the east side of the Sierra Nevada Mountains in sugar, whitebark and western white pines. The rust has expanded its range in Nevada in recent years, with populations of rust now confirmed in the Jarbidge Mountains. Forest Health Protection conducted a ground survey for WPBR in the mountain Ranges in eastern Nevada primarily focused on high elevation Great Basin bristlecone pine in 2004. No newly infected areas were discovered, and the previously reported rust infection in the Ruby Mountains was found to be dwarf mistletoe. At this point the only confirmed population of white pine blister rust in eastern Nevada is in the Jarbidge Mountains. There is concern that WPBR could become established in sensitive populations of Great Basin bristlecone pine. In 2010, researchers initiated an effort to collect seed from Great Basin bristlecone to include this species into breeding efforts aimed at detecting resistance to WPBR in 5 needle pines. Additionally, seed from bristlecone in Great Basin National Park was collected in 2011.

Sudden Oak Death
Phytophthora ramorum

Sudden Oak Death (SOD), a newly identified forest disease caused by the pathogen *Phytophthora ramorum*, has been killing thousands of tanoak and oaks in the coastal areas of California, but has not been observed in Nevada. However, with the release of potentially infected nursery stock into all 50 states from a single California nursery, NDOA officials contracted with the USFS to conduct surveys in forest areas on host and potential host species near nurseries or where landowners may have out planted this potentially infected stock. Nevada Division of Forestry personnel have assisted NDOA officials with these surveys. NDOA forest SOD survey data showed no SOD for all regions surveyed to date.

ROOT DISEASES

Annosum Root Disease
Heterobasidion annosum

Hosts: Douglas-fir, lodgepole pine, Jeffrey pine, ponderosa pine, spruce, true firs, and incense cedar

This disease can be found throughout the state on true firs, but it frequently acts as butt decay or as a saprophyte on dead trees, stumps, roots, and cull logs or fallen stems. Annosum can be found in mature trees on the east side of the Sierras and the fungus can kill young ponderosa pine, especially in plantations on droughty soils. Symptomatic small trees can frequently be found around infected stumps with butt decay. The symptoms on larger trees include a thinning crown, decay in the root system and fruiting bodies that develop at the base of the tree or inside stumps.

Figure 33 - Annosum root disease conk at the base of a tree.

Armillaria Root Disease
Armillaria spp.

Hosts: All trees

Evidence of Armillaria root disease can be found throughout the state causing mortality in all species of trees. This disease also frequently functions as a weak pathogen or saprophyte. Fruiting bodies grow in clusters from the roots or at the base of the tree during moist conditions. There is a close association between root disease pockets and endemic level bark beetle populations. Armillaria was observed on pinyon pine roots in the Virginia Highlands of Storey County and on white fir in the Success Summit area of the Schell Creeks of White Pine County in 2006. It has also been found on Jeffrey pine roots in Carson City County in the Clear Creek area.

Figure 34 - Armillaria mushrooms, photo: Gail Durham

Black Stain Root Disease
Ophiostoma wageneri

Hosts: pinyon pine, ponderosa pine, and Douglas-fir

Figure 35 - Black stain root disease on pinyon pine in Storey County, NV, 2011

Black stain root disease is an important disease of several hosts, but it is only found on pinyon pine in the state of Nevada. It usually kills affected trees within a few years, and it can produce groups of mortality that are several acres in size. Pockets of infected trees are preferred host for low-level populations of pinyon engraver beetles. No new pockets of black stain root disease were observed by aerial survey in 2010, but pockets were found in the Virginia Highlands in Storey County in 2011 after ground disturbing mastication activities (see Figure 35).

LEAF AND NEEDLE DISEASES

Aspen Leaf Spot
Marssonina populi

Host: Aspen

Blight and leaf spot caused by this disease have been seen in the past throughout the host type. Although it was not observed in aerial surveys in 2010, it has been seen in the northern

Figure 36 - Symptoms of aspen leaf spot disease.

Toiyabes in heavily frost damaged aspen stands.

DECLINES / COMPLEXES

Subalpine Fir Mortality Complex

Host: Subalpine fir
The western balsam bark beetle (WBBB) is the most significant mortality agent in a complex of forest insects and disease causing subalpine fir mortality. Endemic populations will occur in storm-damaged trees, slash, or trees of poor vigor. WBBB infestations may build to epidemic levels, where mortality can occur in groups of 100 to 10,000 trees. Annosum root disease, woodborers and several species of smaller bark beetles are also involved in this complex. Environmental stress due to drought or overcrowding may also have a role in the death of trees in this category.

In 2012, mortality attributed to subalpine fir mortality complex was 78% of 2011 mortality and resulted in the death of 773 trees (Figure 37). The acreage affected in 2012 was 712 acres. Most of this subalpine fir mortality was on the Mountain City and Jarbidge Ranger Districts of the Humboldt-Toiyabe National Forest in Elko County.

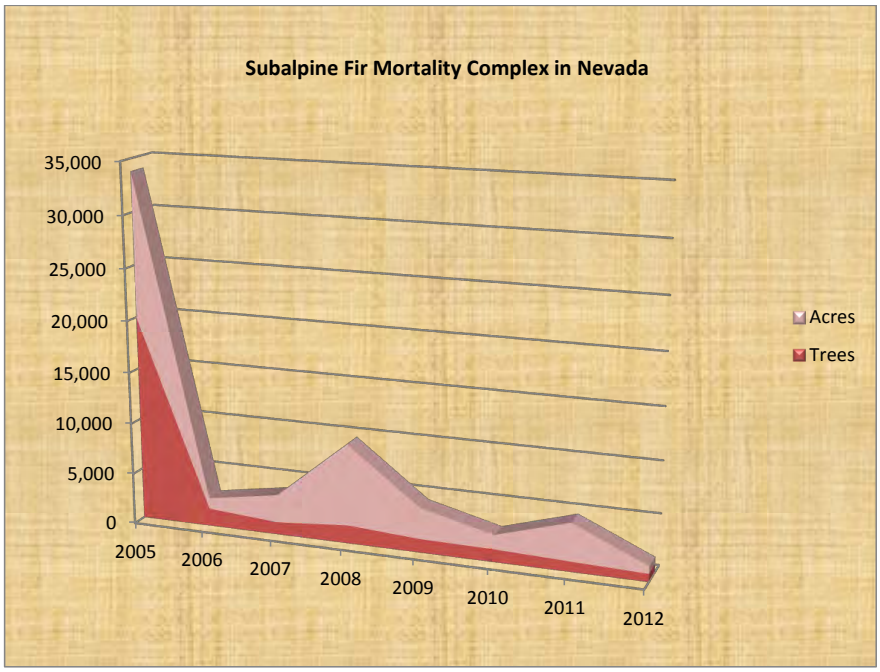


Figure 37- Trees and acres of subalpine fir affected in Nevada from 2005-2012.

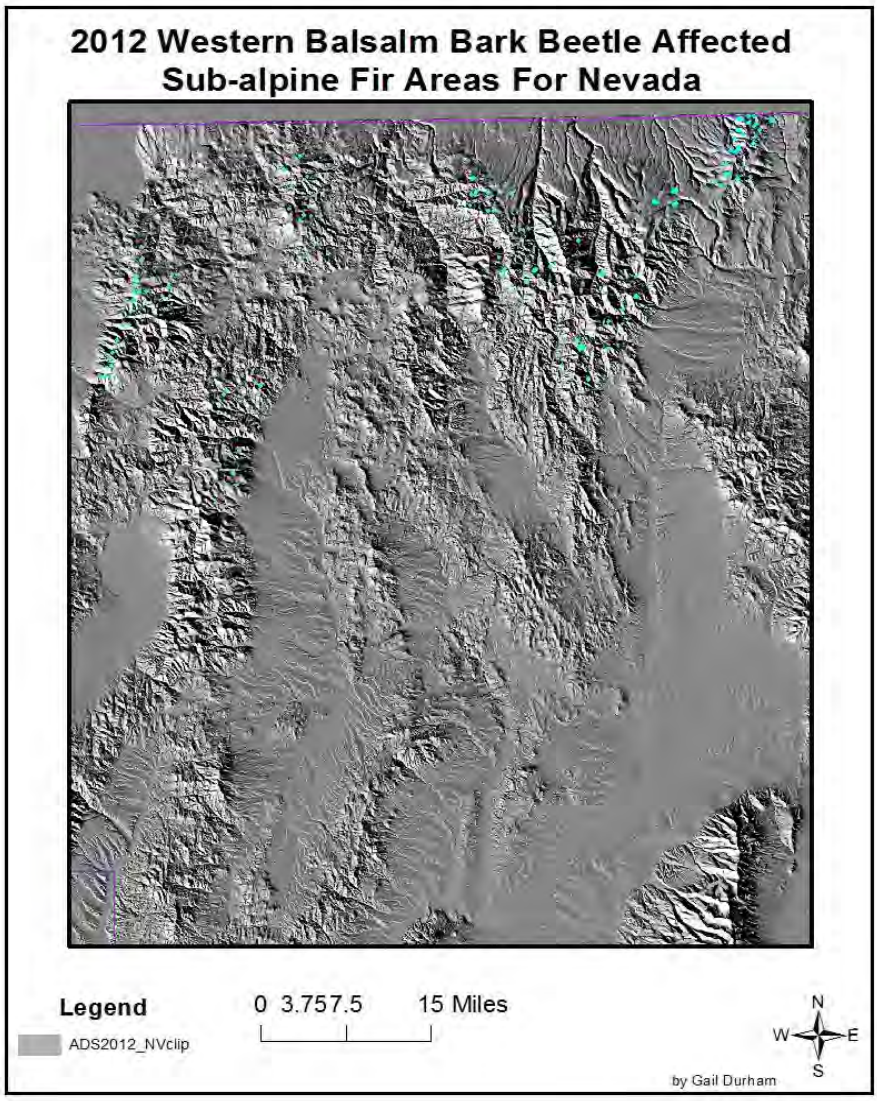


Figure 38 - Subalpine fir mortality 2012 in Elko County, NV.

Elko County – Over 773 trees on 712 acres in scattered patches of mortality were mapped in the Jarbidge Mountains, including the Jarbidge Wilderness, in the Elk Mountains, the Bull Run Mountains, the Mahoganies, Merritt Mt, and the northern Independence Mountains.

Aspen Decline/Dieback
Host: Aspen

A decrease in the amount of aspen forest acreage has been reported throughout the western U.S. for many years. The primary factors involved are succession of aspen forest to other vegetation types due to fire exclusion, and damage to young aspen sprouts by grazing animals. This phenomenon has been labeled “aspen decline” by some authors. This type of “decline” should be distinguished from the aspen dieback that has been detected in aerial survey that is caused by several agents including drought stress, insects, diseases and other stresses. This dieback can impact aspen clones that have been impacted by fire exclusion and grazing pressure causing them to decline and die.

Aspen dieback has been noted anecdotally for many years in the Intermountain Region, and dieback has been recorded by aerial survey since 2003. In 2004, Intermountain Region FHP examined what had been mapped as insect defoliator damage or Cytospora canker in several areas in north-central Nevada and discovered that a number of insect and disease agents were involved. In 2006, FHP established monitoring plots in several areas in Nevada.

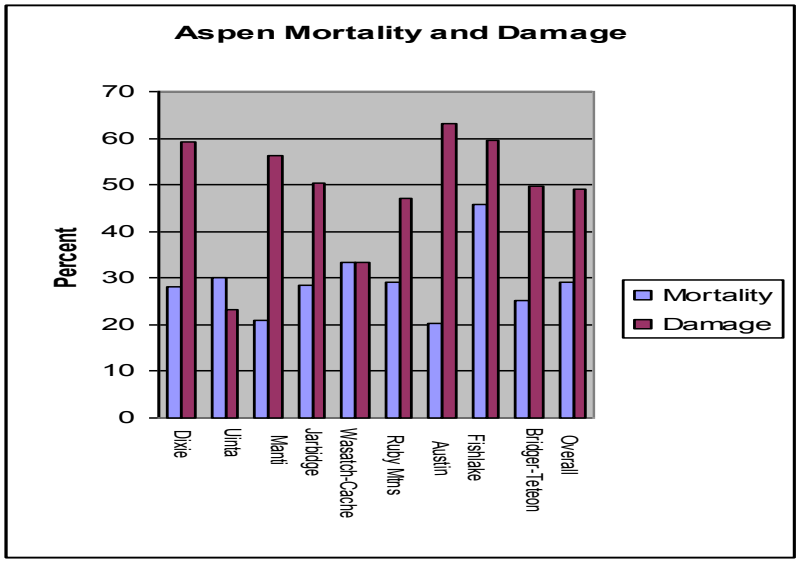


Figure 39 – Percentage of aspen damaged and killed in National Forest Ranger Districts in 2006.

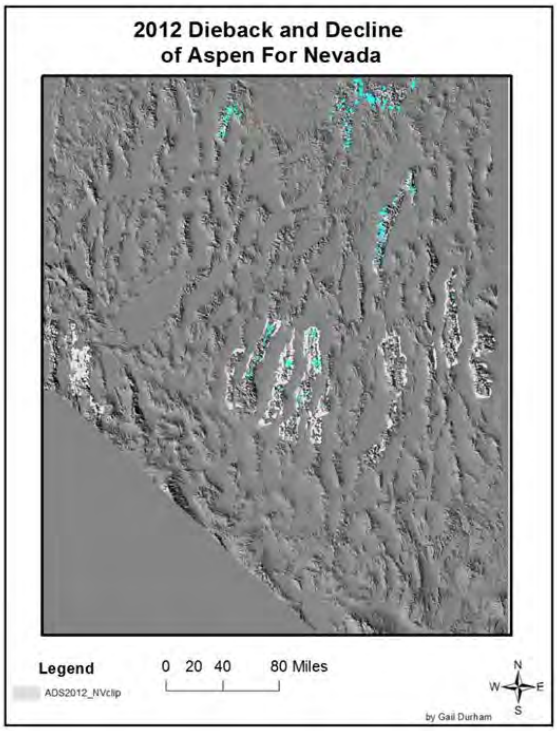
Data analysis of these plots is ongoing but a few trends were evident from an early review of the data. In the areas evaluated, there were observed high levels of mortality and moderate to heavy damage in the trees over 2 inches in diameter at breast height (Figure 39). The most common agents involved were canker diseases and insect borers. In the aspen regeneration, the number of trees per acre was highly variable (Table 6). In some cases regeneration was heavily damaged, primarily by animal browsing.

In many cases, if grazing pressure was not heavy, the clones involved seemed to be recovering and had produced a good crop of new sucker sprouts. However, in some cases heavy grazing pressure was removing sucker sprouts produced as a response to death of overstory trees, which may contribute to the eventual death of these clones. In other cases, the clones were not recovering, even in the absence of grazing pressure.

Table 6. 2006 aspen regeneration plots on National Forests (NF) and Ranger Districts (RD).

Forest (District)	**Trees per acre**	**Percent Damaged**
Dixie NF	2,300	57.4
Uinta NF	416	5.2
Manti NF	5,600	25.4
Wasatch-Cache NF	4,300	11.6
Humboldt-Toiyabe NF (Jarbidge RD)	3,360	36.9
Humboldt-Toiyabe NF (Rubies RD)	1,450	47.8
Humboldt-Toiyabe NF (Austin RD)	1,813	68.9
Fishlake NF	3,550	47.9

In 2012, 6,319 acres of aspen dieback/decline were mapped in nine counties. This is an increase of 141% of 2011's figures. Affected acreage increased in most counties such as Douglas, Elko, Eureka, Humboldt, Lander, Lyon and Nye, and White Pine, but slight decreases were seen in Nye and Washoe counties.



Douglas County – 29 acres of decline was mapped in one spot in the headwaters of Mill Ck in the Pinenut Mts.
Elko County – 4,077 acres of dieback/decline was mapped in numerous spots in the Jarbidge Mountains, in small spots throughout the Tennessee, Mahoganies, Elk, Bull Run, Independence, East Humboldt, and Ruby Mountains. Some larger pockets were mapped near Buck Creek, Corral Creek, Fox Creek, west of Wrangle Mtn. and near Lime Creek Basin.
Eureka County – 228 acres of light dieback was mapped in four small spots in the northernmost end of the Monitor Range
Humboldt County – 495 acres of aspen dieback occurred in a number of small spots throughout the Santa Rosa Range.
Lander County – 194 acres of aspen dieback occurred in a number of small spots on the north end of the Toiyabe Range just south of Austin Summit to just north of Kingston Canyon.
Lyon County –3 acres was found in a spot in the southern Sweetwater Mts.
Nye Counties – 1,128 acres of dieback was mapped in one spot midpoint of the Hot Creek Mts, and numerous spots in the upper elevations of the northern, Shoshone, Toiyabe, Toquima and Monitor Mountains.
Washoe County –17 acres in one spot near Mogul Peak.

White Pine County –148 acres in one small spot in the central White Pine Range at the headwaters of Cottonwood Creek , the west slope of the Mt Moriah Wilderness area, and two spots in the northeast Schell Creek Range south of Centerville, and one just north of Success Summit .

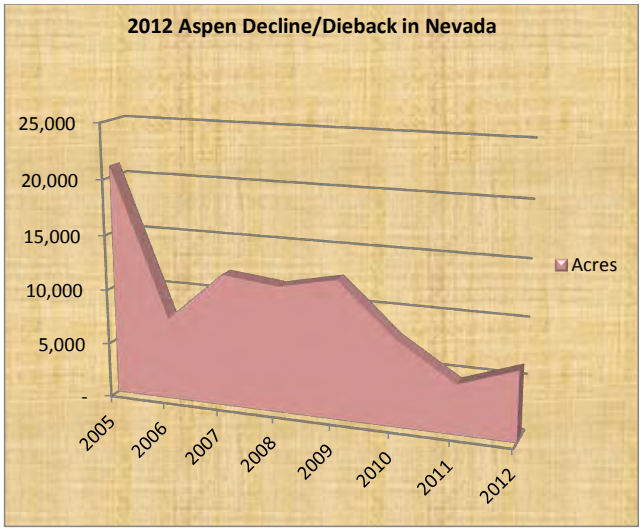


Figure 40 – 2012 acres with aspen dieback in Nevada and graph of Nevada aspen decline/dieback from 2005-2012.

Cytospora Canker
Cytospora spp.

Host: aspen

Cytospora canker is one of the most common diseases affecting aspen in ornamental situations and often attacks stressed trees through wounds. This fungus girdles branches by killing the cambium. Large, vigorous trees can withstand the disease and are rarely killed. Activity from this pathogen is most likely a symptom of several years of water stress or defoliation from other insects or diseases. From the air, decline due to Cytospora canker can look similar to decline by forest tent caterpillar defoliation. The decline was mistakenly identified by aerial observers as forest tent caterpillar defoliation in 2002 and 2003. Further field study is needed to determine all the decline causes. In 2009, much of the aspen decline showed overstory decline but the understory regeneration was healthy.

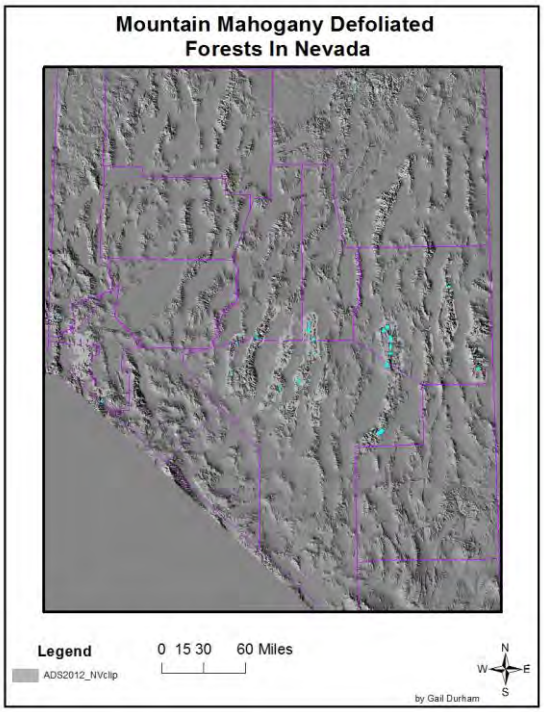
ABIOTIC DAMAGE

Drought Damage

Host: curlleaf mountain mahogany

Extensive yellowing and loss of curlleaf mountain mahogany (*Cercocarpus ledifolius* Nutt. Ex Torr. & Gray) foliage was seen from 2007 through 2011 throughout the state. These evergreen leaves had turned yellow or red before dropping. In many areas, only small tips of green leaves remained on the trees. In many of the areas that were declining, mountain mahogany mortality has occurred in the centers of the large patches (Figure 42). In 2011, the mahogany appeared to recuperate, although many stands have dead centers. The amount of decline decreased in 2011 again (Figure 42).

In 2012, the affected acreage (6,881 acres) increased to 132% of the 2011 acreage (5,256) (Figure 42). In 2012, the number of counties affected increased to seven from the five affected in 2011. Again, White Pine County had the majority of the damage followed by Nye County with small amounts in Douglas, Eureka, Lander, Lyon, and Washoe Counties. The below average precipitation of 2012 was most likely the reason for the slight increased defoliation of mountain mahogany this year



Eureka County – 437 acres of light decline was mapped in six patches at the north end of the Monitor Range.
Lander County – 208 acres of decline was observed in two patches in Porter and Crane Canyon headwaters of the west central Toiyabe Mountains.
Lyon County – 61 acres of decline was observed in two patches in the headwaters of Sheep Creek in the Sweetwater Mts.
Nye County – 3,681 acres of decline was mapped in many small-sized patches throughout the Toiyabe, Shoshone, one patch just south of Meadow Canyon in the Toquima Range, a patch at the headwaters of Savory and South Fork of Mosquito Creeks and numerous small patches in the northern section of the Monitor Mts, and one large patch on the southernmost end of the Grant Range just northeast of Cherry Summit and three small patches in the south end of the White Pine Range.
Washoe County – 41 acres of decline was observed in small patches along the Carson Range south of Thomas Creek in southwestern Reno.
White Pine County – 2,453 acres of decline was mostly detected in small patches in the lower elevations of the White Pine, one small patch south of Silver Canyon in the Schell Creek Range, two small spots northern Snake, and one large patch in the Great Basin National Park on the southern end of the Snake Range at the headwaters of Big Spring Wash.

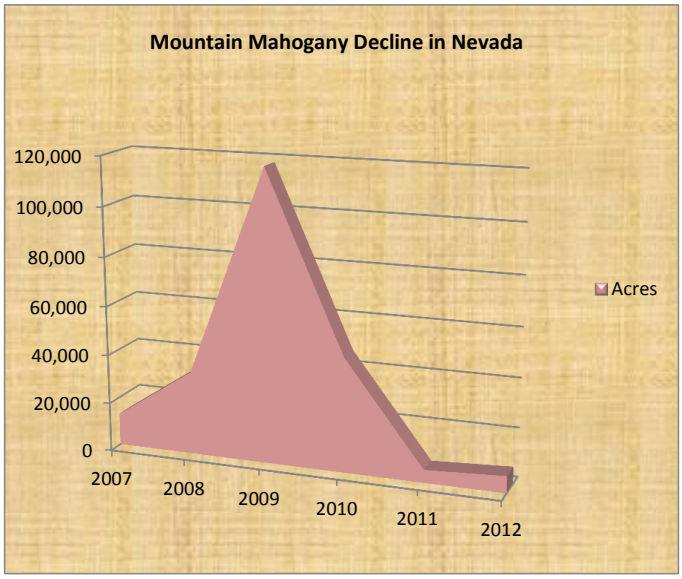


Figure 42 – The 2012 acreage of curlleaf mountain mahogany decline and graph of the decline from 2007-2012.

Blowdown

Areas of concentrated, high velocity winds can cause trees to blow over. Blowdown occurs in groups or as scattered trees within the landscape. Depending on the tree species, patches of blowdown in coniferous forests can provide a food source for various bark beetles, enabling populations to build to epidemic levels. These epidemic populations may then attack and kill standing, live trees adjacent to the blowdown. No blowdown was mapped in 2012.

Wildfire Damage

A few fires, in Nevada, burned thousands of acres of pinyon pine and Jeffrey pines . Wildfire damamgein 2012 includes: 50 Jeffrey pines on 25 acres along Edgewood Creek on the west side of Kingsbury Grade in Douglas County; 40 Jeffrey pines on 20 acres north of Balls Canyon in Washoe County; 2,200 pinyon pines over 3,000 acres in the southern and western Pinenut Mountains in Douglas County; and 1000 pinyon pines on 703 acres in Nye county in the Quinn Canyon Range on the eastern lower slopes of the North Fork of Cottonwood Creek.

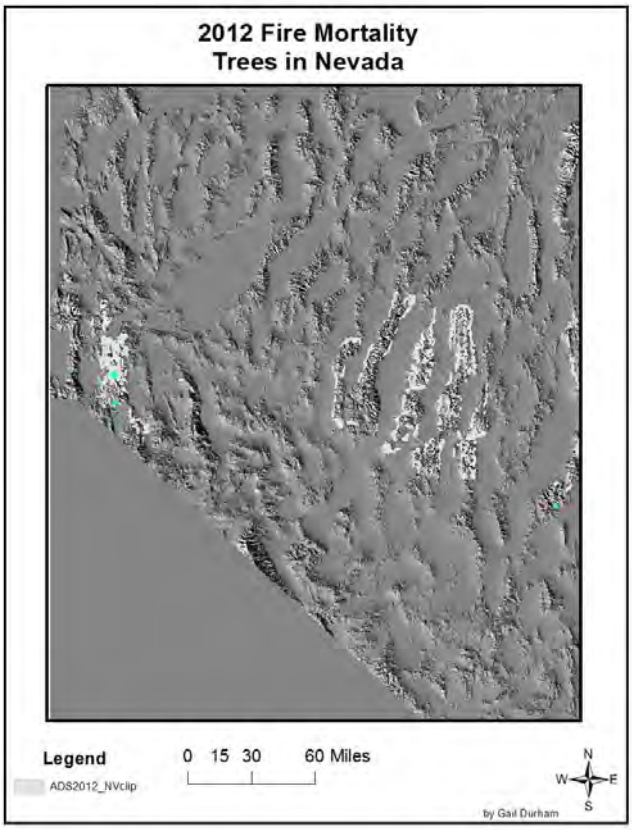


Figure 43 - Mapped fire damaged forest areas in Nevada in 2012

Frost Damage

Aspen damage due to frost was mapped extensively throughout the mountain ranges of Nevada including the Snake, Schell Creek, Egan, Quinn Canyon, White Pine, Toiyabe, Shoshone, Santa Rosa, Pinenut, Sweetwater and Carson Ranges. The total mapped acreage in NV was 5,195. Most of this re-foliated after the early summer damage, but it was not a full re-foliation and the stands appeared partially defoliated from the air.

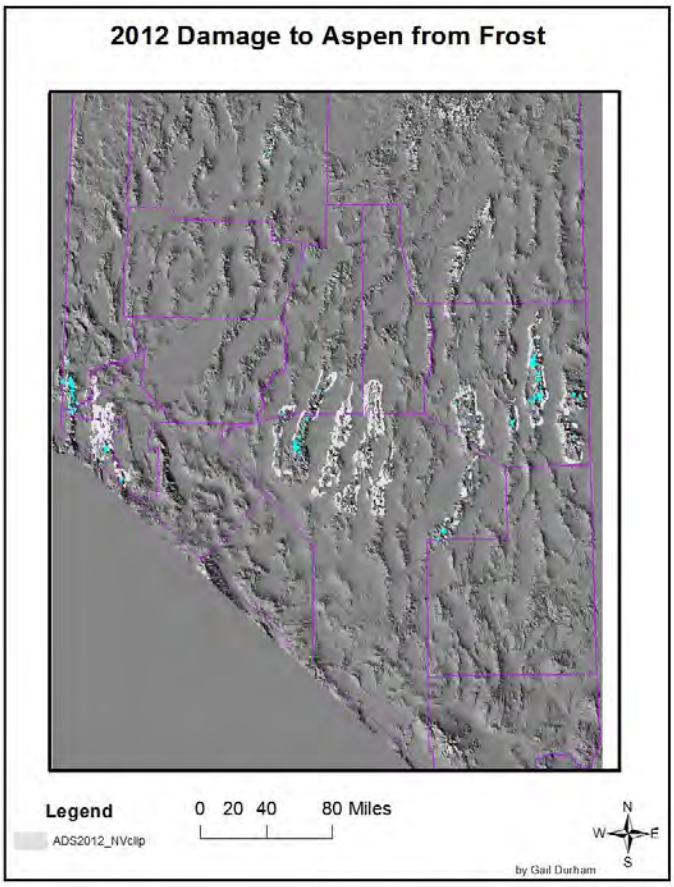


Figure 44 – Aspen damaged by frost mapped in 2012

Noxious weeds

Noxious weeds are a continuing problem for all Western states. They have the ability to colonize disturbed habitats, aggressively displacing native plant species and altering ecosystems. Several state and federal agencies have the responsibility for monitoring and controlling noxious weeds. Our intention by including this information is to increase awareness of these potential problems. Table 5 at the beginning of this document is the list of plants declared noxious weeds by the State of Nevada for specific counties. The NDOA in coordination with the Nevada Department of Conservation and Natural Resources' Natural Heritage Database Program had hired a Weed Geographic Information System Mapping Coordinator, Kim Williams, who significantly helped with monitoring weed populations in Nevada. There is no more funding for this work at this time. For more up-to-date information on Nevada Noxious Weeds and the three-tier State List go to:
http://www.agri.nv.gov/PLANT_NoxWeeds_index.htm

Toadflax Bio-control
Toadflax stem boring weevils (*Mecinus janthinus*)

On June 2, 2010 NDOA made a trip to Salt Lake City to collect the stem boring weevil (*Micinus janthinus*) off of Dalmatian toadflax. On June 3, 2010 an inspection of the five release sites in Pioche Nevada was performed. One of the four sites had been mowed down in the spring. Of the remaining four, all had signs of insect damage with three of the four sites having adult weevils on the plants. Three additional releases of 300 weevils each were conducted on June 3, 2010 in Pioche at the Main Street mine tilling, the elementary school, and the water treatment area. Two additional inspections of the Pioche sites were conducted on August 30, 2010 and November 3, 2010; all sites showed signs of plant damage and over wintering adults.

On June 9, 2010 an inspection of the Gold Hill and Gardnerville release sites was conducted. No signs of establishment have been seen since the initial release in 2007. On the June 9, 2010 another release of 500 weevils each was conducted at both sites. One additional inspection of these sites was conducted on October 16, 2010 with both sites having a small number of over wintering adults in their stems.

On November 17, 2010 a trip was made to Salt Lake City to collect stems with over wintering adults. They were brought back to Reno and place in cold storage to be reared out and released in the spring of 2011.

The following noxious weed websites, while not inclusive, give additional information on noxious weeds such as biology, history, and control.

http://www.invasivespecies.gov
This website is the gateway to federal and state efforts concerning invasive species. There are links to numerous invasive species databases. This website should be one of your first stops.

http://www.agri.nv.gov/PLANT_NoxWeeds_index.htm

This website contains any information you need about noxious weed prevention, control and management for all land managers in the state of Nevada.

http://www.cdfa.ca.gov/phpps/ipc/encyclowedia/encyclowedia_hp.htm
California Department of Food and Agriculture has a very comprehensive website. Information includes: identification, biology, and management. Pictures of the plants in various stages are just a click away.

http://www.nwcb.wa.gov/index.htm
State of Washington's noxious weed control board website has information on black henbane, buffalo bur, camel thorn, Canada thistle, Dalmatian toadflax, dyer's woad, goatsrue, houndstongue, johnsongrass, jointed goatgrass, diffuse, Russian and spotted knapweed, leafy spurge, Mediterranean sage, musk thistle, perennial pepperweed, purple loosestrife, puncturevine, rush skeletonweed, silverleaf nightshade, scotch thistle, St. Johnswort, yellow nutsedge, purple and yellow starthistle, and velvetleaf. Topics include description, economic importance, geographic distribution, habitat, history, growth and development, reproduction, response to herbicides, response to cultural controls, and biocontrol potentials.

http://www.ipm.ucdavis.edu/PMG/selectnewpest.landscape.html#WEED
University of California pest management website has information on Bermuda grass, field bindweed, Russian thistle, yellow starthistle, and others. Topics include identification, biology, and management through cultural and chemical control options.

http://www.ext.colostate.edu/pubs/natres/pubnatr.html
Colorado State University Cooperative Extension website in the Range section has fact sheets on musk thistle, leafy spurge, Canada thistle, diffuse, Russian, and spotted knapweeds. Information includes description, phenology, and management options such as cultural, chemical, mechanical, and biological.

http://www.weedcenter.org
An interagency website housed at the Montana State University. The Center for Invasive Plant Management (CIPM) promotes the ecological management of invasive plants in the West through education, by facilitating collaboration among researchers, educators, and land managers, and by funding research projects and weed management areas. The center serves as an information clearinghouse, providing examples of ecological management, and delivering implementation tools and products to land managers. The center operates in partnership with federal, state, counties, private industry, universities, foundations, and landowners.

http://invader.dbs.umt.edu
The University of Montana's Invaders Database has a search engine that links the user to informational websites on most of the invasive weeds. You can search the database for the list of Noxious Weeds by state and most identified plants have additional information and links to more information.